156

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INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE 'ANNALS' COMBINED WITH LOUDON AND CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY.')

CONDUCTED BY

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"Omnes res creatæ sunt divinæ sapientiæ et potentiæ testes, divitiæ felicitatis humanæ:—ex harum usu *bonitas* Creatoris; ex pulchritudine *sapientia* Domini; ex œconomiâ in conservatione, proportione, renovatione, *potentia* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper æstimata; à verè eruditis et sapientibus semper exculta; malè doctis et barbaris semper inimica fuit."—LINNÆUS.

"Quelque soit le principe de la vie animale, il ne faut qu'ouvrir les yeux pour voir qu'elle est le chef-d'œuvre de la Toute-puissance, et le but auquel se rapportent toutes ses opérations."—BRUCKNER, *Théorie du Système Animal*, Leyden, 1767.

. . . . The sylvan powers
Obey our summons; from their deepest dells
The Dryads come, and throw their garlands wild
And odorous branches at our feet; the Nymphs
That press with nimble step the mountain thyme
And purple heath-flower come not empty-handed,
But scatter round ten thousand forms minute
Of velvet moss or lichen, torn from rock
Or rifted oak or cavern deep: the Naiads too
Quit their loved native stream, from whose smooth face
They crop the lily, and each sedge and rush
That drinks the rippling tide: the frozen poles,
Where peril waits the bold adventurer's tread,
The burning sands of Borneo and Cayenne,
All, all to us unlock their secret stores
And pay their cheerful tribute.

J. TAYLOR, *Norwich*, 1818.

ALERE FLAMMAM.

CONTENTS OF VOL. IX.

[SECOND SERIES.]

NUMBER XLIX.

NUMBER L.

NUMBER LI.

NUMBER LII.

Page

NUMBER LIII.

NUMBER LIV.

PLATES IN VOL. IX.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SECOND SERIES.]

"................. per litora spargite muscum,
Naiades, et circùm vitreos considite fontes :
Pollice virgineo teneros hìc carpite flores :
Floribus et pictum, divæ, replete canistrum.
At vos, o Nymphæ Craterides, ite sub undas ;
Ite, recurvato variata corallia trunco
Vellite muscosis e rupibus, et mihi conchas
Ferte, Deæ pelagi, et pingui conchylia succo."
N. Parthenii Giannettasii Ecl. 1.

No. 49. JANUARY 1852.

I.—*Notes on the* Diatomaceæ ; *with descriptions of British species included in the genus* Pleurosigma. By the Rev. Wm. Smith, F.L.S.

[With two Plates.]

[Continued from vol. vii. p. 14.]

In all systematic descriptions of the *Diatomaceæ*, the genus *Navicula* occupies a prominent place ; in some arrangements, indeed, the terms *Naviculaceæ* or *Naviculeæ* are adopted as the designations of the entire tribe, in others as the titles of an extensive family, and, even when most circumscribed, embrace a vast number of closely allied species whose distinction and identification present grave difficulties to the progress of the systematist. In Prof. Kützing's latest work on the *Diatomaceæ* (Species Algarum, 1849), the genus *Navicula* includes 174 species ; and when it is remembered that these minute organisms require the careful employment of the microscope for their detection, and vary from each other by diversities in form so slight, or valvular markings so delicate, that the highest powers of our best instruments are called into constant requisition, it will not appear remarkable that the most judicious descriptions, aided by carefully prepared

figures, sometimes fail in enabling the student to arrive at the satisfactory determination of species.

It appears to me that somewhat of this difficulty might be removed by a subdivision of this extensive genus, and by adopting as generic distinctions those minuter diversities of structure which the latest improvements in our microscopes have enabled us to detect, and which seem to me not less important than those upon which former observers have relied.

In pursuing this course I shall restore the genus *Pinnularia* of Ehrenberg, rejected by Kützing, and adopt the term *Pleurosigma*, as descriptive of another group.

The genus *Navicula* of Kützing and other writers will then be resolved into three, whose characters may be given as follows:

PLEUROSIGMA, mihi.

Valves convex, sigmoid, striated; striæ resolvable into dots.

NAVICULA, Bory.

Valves convex, lanceolate or elliptical, smooth or striated; striæ resolvable into dots.

PINNULARIA, Ehren.

Valves convex, oblong or elliptical, ribbed or pinnated with distinct costæ, not resolvable into dots.

The first of these genera is well distinguished by its sigmoid form; the two latter contain species which approach each other in outline, but may easily be discriminated by the character of their striæ, which invariably present in *Pinnularia* the appearance of continuous ridges or costæ, and which no increase of magnifying power enables us to resolve into separate markings; while in *Pleurosigma* and *Navicula*, the striæ which are apparent with a low magnifying power as simple lines, become on the application of more powerful glasses, or the careful adjustment of the light under which the valves are viewed, distinct series of dots or beads probably arising from elevations on the surface of the valves. In *Navicula* it occasionally happens that the elevations are comparatively distant, and may be recognized with a power of 200 diameters or under; but in *Pleurosigma* the resolution of the striæ into their constituent beads becomes a task of extreme difficulty, and has from this circumstance been very generally adopted by microscopists as a means of testing the defining power of the object-glass. It now seems to be generally admitted, that although the detection of the striæ on *Pleurosigma* requires the object-glass to be of accurate construction and considerable power, yet the resolution of these striæ into beads depends chiefly on

the angular aperture of the lens, and the judicious adjustment of the light; and that an instrument which may be brought by the skilful manipulator to exhibit the most delicate markings of these beautiful objects, may in the hands of a less familiar observer altogether fail in the performance of its work, and appear inferior to another of equal power under more experienced management.

It must also be observed, that the employment of the high powers required is liable to the intrusion of optical error, and cannot be altogether depended upon. I am not indeed prepared to subscribe to Schleiden's assertion, that, "if any one should affirm that he saw something magnified 3000 diameters that could not be seen at a much lower power, it may safely be pronounced to be mere imagination;" yet I am persuaded that the use of powers such as he alludes to can only be obtained under very unfavourable conditions of light, is not available under ordinary circumstances, and should not be made a requisite for the detection of genera or species. I have, therefore, thought it better to confine myself, as far as the discrimination of species is concerned in the figures and descriptions I am about to give, to such circumstances as may be easily noted by any observer provided with an instrument magnifying 400 diameters, giving however, for the gratification of the more curious, a few sketches (Pl. I. fig. 2, & Pl. II. figs. 17, 18, 19), drawn on a larger scale, which have been kindly furnished by the Rev. W. Kingsley of Cambridge, who has devoted great attention to this interesting subject, and succeeded in availing himself of powers hitherto considered unmanageable.

The presence of striæ on the valves of *Pleurosigma* and *Navicula* may be known, even when the power employed is insufficient to detect lines, by the colour of the desiccated frustules viewed by transmitted light. This colour differs in each species, and slightly varies with the age of the individual specimen. It arises from the refraction of the rays passing through the siliceous plate, and its shades depend on the direction of the striæ, and their distance from each other; its aid may therefore be evoked in the discrimination of species, and will sometimes be found to be the most facile and certain means of identification. Another means of detecting species is furnished by the direction of the striæ, whether oblique, perpendicular, or parallel to the median line. These circumstances are not difficult of recognition with the power I have adopted, and are shown by the greater amplification of Mr. Kingsley to depend upon the position of the beads in reference to each other, the striæ appearing as oblique when the beads of two contiguous rows are arranged alternately or in quincunx, and transverse and longitudinal when these dots are

placed in regular squares or in direct opposition to each other. It may be as well to remark in this connection, that in the following descriptions when the distance between the striæ is mentioned, the distance between the beads in the same row may be known by reversing the application of the terms longitudinal and transverse: thus when the longitudinal striæ are said to be $\frac{1}{30000}$th of an inch apart, it follows that this fraction denotes the distance between the beads in a transverse direction and *vice versâ.*

In all the forms described in this paper, and in the *Naviculeæ* generally, we may observe that each valve is traversed by a median line across which the striæ do not pass. The centre and extremities of this line are somewhat enlarged, and these enlargements have been regarded by many writers as openings in the siliceous plates. I have never been able to satisfy myself that such openings exist, and am disposed to regard the line itself and its enlargements as peculiarities little connected with the essential structure or functions of the cell. More important in a structural point of view is the form of the connecting membrane, which in *Pleurosigma* consists of a narrow ring of silex, and which in no period of its growth appears to have any very considerable development. The consequence is that the front view of the frustule is uniformly of a linear, or when the convexity of the valves is considerable, of a linear-lanceolate form, while in *Navicula* and *Pinnularia,* as the connecting membrane is often more fully developed, the front view of their frustules is frequently oblong or quadrilateral. Too much importance must not, however, be attributed to this aspect of the Diatomaceous frustule, as its form greatly depends upon the stage to which self-division has arrived, and may vary from linear to oblong, or from very narrow to very broadly-lanceolate in the same individuals.

The reproduction, or more strictly speaking, the multiplication of these organisms, has been noticed only under the form of self-division, the phænomena connected with which I have detailed in a former paper (Ann. Nat. Hist. 2nd Ser. vol. vii. p. 4); I give an example in the present connected with *Pleurosigma attenuatum* (Pl. II. fig. 13). By means of self-division the numbers of these minute objects increase with amazing rapidity, and the consequence is that when found they generally occur in multitudes so vast that their aggregation forms a brownish film on the surface of the mud, or a visible covering to the stones or plants to which they attach themselves. That these great numbers frequently arise from self-division is evident from the circumstance of their being nearly all of exactly the same size, in the same locality; and that they may have originated within a brief period, will not appear surprising if we consider the rapidity with which increase in geometrical progression advances even

from unity when each step doubles upon the preceding. Thus, supposing self-division to be perfected in twenty-four hours, a single frustule will in one month have increased to upwards of a thousand millions! But it is also certain that the *Naviculeæ*, like some other *Diatomaceæ*, have a specific mode of reproduction, since we often find frustules in various stages of growth, as is evident from the diversities of their size (Pl. I. figs. 7 & 9; Pl. II. figs. 1, 2 & 3, 9 & 10, 11 & 12), and from the greater delicacy of the striæ in individuals of the same species; circumstances which are incompatible with the process of self-division, where the half-new frustules must of necessity be precisely counterparts of the old. The mode in which the germinative power is renewed, when exhausted by self-division, remains still to be discovered; it will probably be found to be a process analogous to that of conjugation in the *Desmidieæ*, and which is known to obtain in some of the families belonging to the *Diatomaceæ*. In the genus under review, the most careful search, at all seasons, and during every stage of growth, has failed in any case to recognise the slightest indications of such a phænomenon.

It may be as well that I should repeat, that the descriptions I am about to give depend upon observations made with a $\frac{1}{4}$-inch object-glass and eye-piece giving together a power of 400 diameters, and that the figures, unless otherwise stated, are drawn with the camera lucida exactly to this scale. The colours mentioned are those of the desiccated valves not immersed in balsam, or any other refracting medium, and are of course only loose and imperfect modes of designating shades and varieties of aspect, which it is impossible to define with accuracy.

Pleurosigma.

Section I. *Beads alternate, striæ oblique: all marine.*

1. *Pleurosigma formosum*, n. sp. Valve linear-lanceolate, gradually attenuated to the somewhat obtuse ends, twisted; median line broad, not central: colour bright chestnut-brown. Average length of valve $\frac{1}{66}$ of an inch, greatest breadth of ditto $\frac{1}{850}$ of an inch. Oblique striæ $\frac{1}{30000}$ of an inch apart (*v. v.*).

Shoreham Harbour, 1850.

This species is well distinguished by the position of its median line, which, owing to a twist in the valves, appears nearly to coincide with the edge for a considerable distance at either end, and then crosses the valve in a diagonal direction, giving a peculiarly beautiful appearance to the frustule, especially when mounted in balsam. Mr. Kingsley has furnished me with a

carefully executed drawing of this species under a power of 5500 diameters; I give a portion of it in Plate I. fig. 2: he remarks, that "the figure of the frustule, produced by the twist in the valves, might be represented by joining together the tip ends of two feathers taken from opposite wings."

Plate I. fig. 1. A valve of *P. formosum*; fig. 2. a portion of the same magnified 5500 diameters.

2. *Pleurosigma speciosum*, n. sp. Valve linear, slightly attenuated, somewhat twisted, extremities obtuse, median line not central: colour a pale straw. Average length of valve $\frac{1}{85}$ of an inch, greatest breadth of ditto $\frac{1}{850}$ of an inch. Striæ $\frac{1}{40000}$ of an inch apart (*v. s.*).

Locality unknown.

A slide containing this species was sent to me by Messrs. Smith and Beck, but without any precise information as to the locality where the specimens had been found. It is a near ally of the former, but of a straighter and stouter habit and more delicately marked; it wants however the gracefulness of the curvature so eminently characteristic of the species first described.

Plate I. fig. 3. A valve of *P. speciosum*.

3. *Pleurosigma elongatum*, n. sp. Valve linear-lanceolate, flexure slight, extremities acute, median line central: colour a clear straw. Average length of valve $\frac{1}{75}$ of an inch, greatest breadth of ditto $\frac{1}{920}$ of an inch. Striæ $\frac{1}{44000}$ of an inch apart (*v. v.*).

Poole Bay, 1848. Brackish water near Lewes, 1850. Hull, *Mr. R. Harrison*!

Not uncommon in pools at half-tide level, and in brackish ditches mixed with other species. It has been distributed by Mr. Harrison under the name of "*Navicula lineata*," but this term, if at all admissible, approaches too nearly the "*lineolata*" of Ehrenberg, which refers to a species wholly different.

Plate I. fig. 4. Valve of *P. elongatum*.

4. *Pleurosigma delicatulum*, n. sp. Valve narrow lanceolate, flexure slight, extremities acute: colour very pale straw with a slight tinge of pink. Average length of valve $\frac{1}{112}$ of an inch, greatest breadth of ditto $\frac{1}{1500}$ of an inch. Striæ $\frac{1}{50000}$ of an inch apart (*v. v.*).

Brackish water; Lewes, 1850.

Very close to the last in outline, but much more delicate, and easily distinguished by its size and colour: it requires the most careful manipulation to discover the striæ with the power I have employed.

Plate I. fig. 5. Valve of *P. delicatulum*.

5. *Pleurosigma strigosum,* n. sp. Valve lanceolate, flexure slight, extremities obtuse: colour straw. Average length of the valve $\frac{1}{90}$ of an inch, greatest breadth of ditto $\frac{1}{800}$ of an inch. Striæ $\frac{1}{38000}$ of an inch apart (*v. v.*).

Rye, *Mr. Jenner,* 1849. Coast of Sussex, 1850. Hull, *Mr. R. Harrison*!

Its stouter habit, darker colour, and more distant striæ distinguish this species from *P. elongatum.*

PLATE I. fig. 6. Valve of *P. strigosum.*

6. *Pleurosigma angulatum,* mihi. Valve broadly lanceolate or quadrangular, extremities acute, flexure moderate: colour a bright chestnut. Average length of valve $\frac{1}{110}$ of an inch, greatest breadth of ditto $\frac{1}{428}$ of an inch. Striæ $\frac{1}{43000}$ of an inch apart (*v. v.*).

β. Valve narrow lanceolate, slightly quadrangular.
γ. Valve much smaller, quadrangular.

Var. β. *Navicula angulata,* Quekett on the Microscope, 1848, p. 438. pl. 8. figs. 4, 5, 6 & 7. *Nav. Æstuarii,* Kütz. Sp. Alg. 1849, p. 490.

On the mud of tidal harbours; very common. Poole Bay; Belfast Bay, Liverpool; Coast of Sussex, &c.; Coast of Lancashire, *Chr. Johnson, Esq.*! Rye, *Mr. Jenner*! Hull, *Mr. R. Harrison*! Norfolk, *Thos. Brightwell, Esq.*!

This species has long been a favourite test with the microscopist, and the fineness of its striæ renders its desiccated valve very suitable for such a purpose. The striæ may be detected with a power of 400 diameters, but to resolve them into beads usually requires a higher power, and the younger frustules demand the best glasses and most careful manipulation for their resolution. The quadrangular form of this species is always more or less present, and seems to distinguish it from all its allies; but for this circumstance var. β. might be confounded with the last species; it is however quite distinct.

PLATE I. fig. 7. Valve of *P. angulatum*; fig. 8. valve of ditto var. β; fig. 9. valve of ditto var. γ.

7. *Pleurosigma distortum,* n. sp. Valve lanceolate, abruptly bent towards the obtuse extremities: colour a very pale pink; striæ obscure. Average length of valve $\frac{1}{320}$ of an inch, greatest breadth of ditto $\frac{1}{1500}$ of an inch (*v. v.*).

With *P. angulatum,* coast of Sussex, 1850.

Probably the young of some other species.

PLATE I. fig. 10. Valve of *P. distortum.*

8. *Pleurosigma obscurum*, n. sp. Valve linear, slightly attenuated towards the obtuse extremities; median line not central: colour a very pale pink; striæ obscure. Average length of valve $\frac{1}{193}$ of an inch, greatest breadth of ditto $\frac{1}{2000}$ of an inch (*v. v.*).

β. much smaller, more gradually attenuated.

In brackish water, Poole Bay, 1849. Lewes, 1851. β. Poole Bay, covering a sponge.

No power I have applied has brought the striæ into view either in this or the last species, but the colour of the dry valves indicates their presence in both cases.

Plate I. fig. 11. Valve of *P. obscurum*; fig. 12. ditto, var. β.

Section II. *Beads opposite, striæ transverse and longitudinal.*

a. Marine.

9. *Pleurosigma Balticum*, mihi. Valve linear, straight, suddenly attenuated towards the sigmoid extremities, which are somewhat obtuse: colour dark brown. Average length of the valve $\frac{1}{83}$ of an inch, greatest breadth of ditto $\frac{1}{850}$ of an inch. Striæ $\frac{1}{38000}$ of an inch apart (*v. v.*).

β. smaller, gradually attenuated.
γ. much smaller, attenuated throughout; striæ obscure.

Navicula Baltica, Ehr., Pritchard's Hist. of Animalcules, 1843, pl. 3. fig. 143; Kütz. Bacill. p. 102. pl. 4. fig. 22; Phy. Ger. p. 95; Sp. Alg. p. 85.

Very common, mixed with *P. angulatum*, in all the localities of that species mentioned above.

A large and handsome species, distinguished by the parallelism of its sides and the great convexity of its valves: the front view is almost linear. It varies much in size from var. γ, which is probably a very young specimen, and does not exceed $\frac{1}{330}$ of an inch in length, to others reaching $\frac{1}{66}$ of an inch. I cannot account for the absence of a central enlargement of the median line in all the figures of this species given by Ehrenberg and Kützing, as in no other of the tribe is this character more plainly discernible.

Plate II. fig. 1. Valve of *P. Balticum*; fig. 2. ditto var. β; fig. 3. ditto var. γ; fig. 17. portion of fig. 1 mag. 3200 diameters (Rev. W. Kingsley).

10. *Pleurosigma Strigilis*, n. sp. Valve lanceolate, uniformly attenuated towards the somewhat acute extremities: colour somewhat paler than the last. Average length of valve $\frac{1}{80}$ of an

inch, greatest breadth of ditto $\frac{1}{830}$ of an inch. Transverse striæ $\frac{1}{33000}$ of an inch apart (*v. s.*).

Hull, *Mr. R. Harrison*!

A very distinct species, notable for its graceful form and strongly marked transverse striæ.

PLATE II. fig. 4. Valve of *P. Strigilis*.

11. *Pleurosigma acuminatum*, mihi. Valve broadly lanceolate, much attenuated towards the extremities: colour a light brown. Average length of the valve $\frac{1}{162}$ of an inch, greatest breadth of ditto $\frac{1}{1200}$ of an inch. Striæ $\frac{1}{45000}$ of an inch apart (*v. v.*).

Navicula sigma, Ehr. 1833; Pritchard, Hist. of Animal. pl. 3. fig. 146. *Nav. acuminata*, Kütz. Linn. 1833; Bacill. p. 102. tab. 4. fig. 26; Phy. Ger. p. 95; Sp. Alg. p. 86.

Shoreham Harbour, 1850.

I have Prof. Kützing's authority, in a letter dated July 1851, for the synonyms of this species, which has occasionally been confounded with the *N. Hippocampus* of Ehrenberg by British microscopists. It differs from it in habitat, in colour, in the delicacy of its striæ, and in its form, which is more slender and attenuated.

PLATE II. fig. 5. Valve of *P. acuminatum*.

12. *Pleurosigma Fasciola*, mihi. Valve lanceolate, extremities produced, flexure considerable: colour very pale. Average length of valve $\frac{1}{240}$ of an inch, greatest breadth of ditto $\frac{1}{1847}$ of an inch. Striæ $\frac{1}{33000}$ of an inch apart (*v. v.*).

Ceratoneis Fasciola, Ehr.; Kütz. Bacill. p. 104. tab. 4. fig. 4; Phy. Ger. p. 96; Sp. Alg. p. 88.

On the mud of tidal harbours. Belfast Bay, 1849. Poole Bay, 1850. Coast of Sussex, 1850. Hull, *Mr. R. Harrison*!

I have restored this species to the same genus as its allies, the elongation of its valves not appearing to require its separation, and the more careful examination of its surface showing the central and terminal enlargements of its median line characteristic of the true *Naviculeæ*.

PLATE II. fig. 6. Valve of *P. Fasciola*.

13. *Pleurosigma prolongatum*, n. sp. Valve much elongated, very narrow lanceolate; flexure moderate; striæ obscure: colour very pale. Average length of valve $\frac{1}{162}$ of an inch, greatest breadth of ditto $\frac{1}{2400}$ of an inch (*v. v.*).

Poole Bay, 1849.

Very like the last, but much more gradually attenuated to the extremities: the striæ are imperceptible.

PLATE II. fig. 7. Valve of *P. prolongatum.*

14. *Pleurosigma littorale*, n. sp. Valve broadly lanceolate, acute; flexure considerable; longitudinal striæ very distinct: colour bluish gray. Average length of valve $\frac{1}{200}$ of an inch, greatest breadth of ditto $\frac{1}{1200}$. Long. striæ $\frac{1}{18000}$ of an inch apart (*v. v.*).

Coast of Sussex, 1850.

A very distinct and curious species. The valves in the broadest part are marked with about fourteen longitudinal striæ, which can be resolved by a moderate power into rows of beads about $\frac{1}{40000}$ of an inch apart. When the light is thrown upon the object so as to exhibit these beads as transverse striæ, the surface appears marked with a succession of short lines or furrows crossing the longitudinal striæ, which still continue visible, and the frustule assumes a very peculiar and beautiful appearance. These effects may perhaps be owing to the circumstance, thus mentioned by Mr. Kingsley: "There are beads on both sides of this valve, and the distances are not the same for both sides, so that with oblique light and imperfect definition, the two sets in some degree obliterate each other and cause a confusion in the image."

PLATE II. fig. 8. Valve of *P. littorale*; fig. 19. portion of same magnified 5500 diameters (Rev. W. Kingsley).

15. *Pleurosigma Hippocampus*, mihi. Valve broadly lanceolate, obtuse; flexure considerable; striæ distinct: colour pale brown. Average length of valve $\frac{1}{166}$ of an inch, greatest breadth of ditto $\frac{1}{1100}$ of an inch. Striæ $\frac{1}{36000}$ of an inch apart (*v. v.*).

Navicula Hippocampus, Ehr., Pritchard, Hist. of Animal. pl. 3. fig. 145; Kütz. Bacill. p. 102. tab. 4. fig. 29; Phy. Ger. p. 95; Sp. Alg. p. 86.

On muddy shores and in brackish pools. Lewes, 1850. Hull, *Mr. R. Harrison*!

The specific name of this species has been given to almost every sigmoid Navicula which has fallen under the notice of the non-scientific observer, whether found in the sea or fresh water. It seems however desirable to confine a term borrowed from a marine object to a species of a similar habitat, and I have therefore adopted it for the present, although it is probable that the next species was the one to which Ehrenberg originally attached the name, as it certainly is the one usually esteemed the

Hippocampus by English microscopists. The figure given by Pritchard from Ehrenberg, and apparently copied by Hassall in his 'Brit. Freshwater Algæ,' pl. 102. fig. 11, approaches the form of the present species, but the localities assigned by Ehrenberg are inland. Kützing, as cited above, has the same figure, and quotes Ehrenberg as his authority for it, but gives a habitat exclusively marine, and having submitted specimens of the following species to his notice, I have his sanction for regarding it as distinct. Under these circumstances I am disposed to believe that the two species have been frequently confounded, and their close resemblance might easily occasion the mistake; their habitats are however quite distinct; the *Hippocampus* is a shorter and stouter species, and when full-grown specimens of each are compared, presents more delicate striæ, requiring higher powers of the microscope, and more careful adjustment for their detection and resolution into beads.

PLATE II. fig. 9. Valve of *P. Hippocampus*; fig. 10. ditto in a young state.

b. Freshwater Species.

16. *Pleurosigma attenuatum,* mihi. Valve elongated, lanceolate, obtuse; flexure moderate; striæ very distinct: colour purplish brown. Average length of valve $\frac{1}{120}$ of an inch; greatest breadth of ditto $\frac{1}{1000}$. Longitudinal striæ $\frac{1}{25000}$ of an inch apart, transverse ditto $\frac{1}{40000}$ of an inch apart (*v. v.*).

Navicula Hippocampus, Ehr.? Quekett on the Microscope, p. 238. pl. 8. figs. 1, 2, 3. *Gyrosigma Hippocampa,* Hassall's B. F. W. Alg. p. 435. *Nav. attenuata,* Kütz. Bacill. p. 102. tab. 4. fig. 28; Phy. Ger. p. 95; Sp. Alg. p. 86.

Very common in streams and ditches mixed with *Oscillatorieæ.* Froome near Dorchester, 1849. Sussex in many places, 1850. Near Guildford, *J. R. Capron, Esq.*! Fossil in deposit from Lough Mourne, Co. Antrim, described in 'Ann. Nat. Hist.' for Feb. 1850. In deposit at Peterhead, Aberdeenshire, described by *Dr. Dickie* in 'Annals,' Aug. 1848!

In the description and figure of this species given by Mr. Quekett, in other respects excellent, an error has been committed in representing the beads as transversely confluent towards the margin of the valve. Mr. Kingsley has judiciously remarked to me, that "this mistake is occasioned by the great convexity of the shell, which causes an apparent overlapping of the beads at the edge; they are however perfectly distinct and may be defined, though not easily so."

PLATE II. fig. 11. Valve of *P. attenuatum*; fig. 12. ditto of a young specimen; fig. 13. *P. attenuatum* in front view showing self-division; fig. 18. portion of fig. 11 magnified 3200 diameters (Rev. W. Kingsley).

17. *Pleurosigma lacustre,* n.sp. Valve lanceolate, much attenuated towards the acute extremities: colour pale brown. Average length of valve $\frac{1}{144}$ of an inch, greatest breadth of ditto $\frac{1}{1100}$ of an inch. Longitudinal and transverse striæ $\frac{1}{45000}$ of an inch apart (*v. v.*).

In ponds and clear ditches near Lewes, 1851.

Its freshwater habitat separates this species from *P. Hippocampus*; its more slender outline, acute extremities, and delicate striæ from both the former species; it is less common than either of them.

PLATE II. fig. 14. Valve of *P. lacustre.*

18. *Pleurosigma Spencerii,* mihi. Valve lanceolate, slightly attenuated, obtuse; flexure slight: colour very pale brown. Average length of valve $\frac{1}{270}$ of an inch, greatest breadth of ditto $\frac{1}{2000}$ of an inch. Striæ $\frac{1}{50000}$ of an inch apart (*v. v.*).

Navicula Spencerii, Bailey, Quekett on the Microscope, p. 440. pl. 9.

Not uncommon in ditches, mixed with *Oscillatorieæ,* near Lewes, 1850. *Mr. C. Poulton,* Reading!

This minute species closely resembles a young specimen of *P. Hippocampus* or *P. attenuatum,* and should probably not be separated from the latter. I can find no difference between the British and American specimens, except that those of the latter in my possession are slightly larger.

PLATE II. fig. 15. Valve of *P. Spencerii* (British); fig. 16. ditto of an American specimen.

Landport Cottage, Lewes, Nov. 1851.

Note.—Since the above was written, I have been informed by Mr. Kingsley, that *P. speciosum* has been found by Mr. Topping at Walton in Essex.

II.—*Notice of a new British* Viola. By CHARLES C. BABINGTON, M.A., F.R.S.*

IT gives me much pleasure to have to record the discovery of another violet to be added to the British flora, which I have recently obtained from my friend Mr. A. G. More of Trinity College, Cambridge. He gathered it in June 1851 on peaty ground in Garry Land Wood near Gort, co. Galway.

It is only recently that we have learned, from the writings of

* Read before the Botanical Society of Edinburgh, Dec. 11, 1851.

Fries and of Grenier, to distinguish the several species which, being apparently rare in Britain, may have been confounded under the name of *V. lactea* (Sm.); and more especially discovered the necessity of separating those of them which possess rhizomes from the non-rhizomatous species. Or possibly it would be more correct to say, that we did not know of the existence of any of the former as native plants. It is curious to observe that Fries (Summa Veg. Scand. p. 34) stated in the year 1846 as a well-ascertained fact, that the whole of his group of "*Pratenses* in Anglia desunt." At that recent date the remark was justly made, for not one species of this well-marked section of Violets had then been recorded from any British locality. In the third edition of my 'Manual' and also in the 'Botanical Gazette' (ii. 144 and 178), I have introduced *V. stagnina* as our only native representative of the group, but it had previously been noticed by Mr. H. C. Watson in his valuable 'Cybele Britannica' (iii. 179). The following is the species now to be added to that group:—

Viola stricta (Hornem.); *anther-spur* short broadly lancet-shaped *blunt* (about twice as long as broad), corolla-spur short blunt (green), *leaves cordate-ovate,* petioles winged at the top, *stipules oblong*-lanceolate leaflike incise-serrate ($\frac{1}{2}$-) shorter than the petioles "on the middle of the stem," primary and lateral stems flowering and elongated.

V. stricta var. humilis, *Fries Mant.* iii. 124.
V. stricta, *Gren. et Godr. Fl. Fran.* i. 180.
V. Ruppii, *Reichenb. Icon. Fl. Germ.* iii. t. 14. fig. min.

The habit is apparently very much like that of *V. stagnina.* Stems erect, in the rather young specimens before me they are 3 or 4 inches in height, slender, glabrous. Leaves shorter and broader than those of *V. stagnina,* and cordate at their base. Stipules, when well developed, large and broad, oblong or oblong-lanceolate, all (on our specimens) about half as long as the petioles, as they are stated to be upon the middle of the stem on the continental more fully grown plants, on the upper part of which they are described as being longer than the petioles. It is highly probable that if our specimens had been allowed to advance beyond the commencement of the flowering state in which they were gathered, they would have produced longer stipules and shorter petioles than those which they now exhibit, and so have quite agreed with the character given in foreign books. The flowers are stated by Fries to be "cœrulescentibus," by Grenier "blue violet;" on the dried specimens they are cream-coloured, but had a slight tinge of blue when fresh; this differ-

ence need not present any difficulty, as those of *V. stagnina* are pale blue when fresh but nearly white when dried: their spur is short, but manifestly longer than the appendages of the calyx, very blunt, and *nearly as green as the calyx*. This greenness of the spur is stated to be constant in this and one or two other species, but I have had no experience of it. The spurs of the anthers are decidedly blunt. The capsules I have not seen, but they are stated to be truncate-obtuse and without elevated nerves.

This species consists, as do most of its allies, of two forms, a larger and a smaller, between which there is often so much difference of appearance as at first sight to lead to the opinion that they are distinct specifically; but an examination of them shows that such is not the fact. Our present plant is the smaller form of what in its larger state is rather extensively distributed in Germany and France, and in its smaller is not very unfrequent in Scandinavia.

This plant is far more nearly allied to *V. stagnina* than to any of our other violets, but the green colour of the corolla-spur, the differently shaped leaves, and remarkably different stipules clearly distinguish it. The short corolla-spur, and also that of the anthers, would be quite a sufficient cause for separating it from *V. canina*, even if the presence of a rhizome (which however I have not had an opportunity of seeing) in *V. stricta* had not afforded so manifest a distinction between them. In *V. pratensis* (Koch), which is very nearly allied to our plant, the central stipules are longer than the petioles (not $\frac{1}{2}$ of their length), the limb of the leaves is markedly decurrent on to the petioles, and the spur of the corolla is not green.

In his invaluable 'Herbarium Normale' (iv. 44) Fries states that specimens of *V. lactea* from Smith himself are exactly *V. pratensis* which is there named by him *V. lactea* accordingly, but in his 'Mantissa tertia' (123) he corrects that error, which originated from his not having then learned to distinguish *V. lancifolia* (his *V. pumila*, not that of Villars, which is *V. pratensis*), my *V. canina β. lancifolia*, from *V. pratensis*.

In Hooker and Arnott's 'British Flora' (Addenda) I am stated to give the name of *V. stagnina* to the violet which they "and most others call *V. lactea*," but it seems to me that great difficulty exists in determining what "most" botanists really do call *V. lactea*. It is even difficult to tell what is the true plant of Hooker and Arnott, as in their text they seem to include under that name *V. lancifolia* and *V. stagnina*, but in their Addenda they state that their *V. lactea* is what I call *V. stagnina*, although many of the localities given for it manifestly are those of *V. lancifolia*. The *V. lactea* of British botanists is most frequently

V. lancifolia, if specimens are to be trusted, and that is certainly the plant primarily intended by Smith. Continental authors do not show any such uniformity, for Smith's name has been applied to *V. pratensis* (*V. pumila*, Vill., not of Hook. and Arn., which is the true *V. canina*, Linn.), *V. stagnina*, and *V. lancifolia*.

III.—*A Catalogue of British Spiders, including remarks on their Structure, Functions, Œconomy and Systematic Arrangement.* By John Blackwall, F.L.S.

[Continued from vol. viii. p. 450.]

107. *Linyphia minuta.*

Linyphia minuta, Blackw. Lond. and Edinb. Phil. Mag. Third Series, vol. iii. p. 191; Research. in Zool. p. 384.
—— *domestica*, Wider, Museum Senckenb. B. i. p. 265. taf. 18. fig. 1; Walck. Hist. Nat. des Insect. Apt. t. ii. p. 255.

The interior of buildings, shrubs trained against walls, crevices in the bark of old trees, and lichens growing upon their trunks and branches are the haunts frequented by this common spider, which is widely distributed in England and Wales. In September the female constructs several subglobose cocoons of white silk of a slight texture, the largest of which measures about $\frac{1}{5}$th of an inch in diameter, and contains from 30 to 40 spherical eggs of a yellowish white colour. The cocoons are generally attached to objects situated near the snare.

108. *Linyphia cauta.*

Linyphia cauta, Blackw. Linn. Trans. vol. xviii. p. 655; Walck. Hist. Nat. des Insect. Apt. t. iv. p. 499.

Angles of walls, overhanging banks, and depressions in the trunks of large trees are the situations in which *Linyphia cauta* fabricates its extensive snare. Though rarely seen, in consequence of the habit of remaining in its retreat during the day, yet it is rather abundant in many parts of England and Wales.

The *Linyphia thoracica* of M. Wider (Museum Senckenbergianum, B. i. p. 261. taf. 17. fig. 10) appears to be nearly allied to this species, but as no description or figure is given of the male, I am unable to determine whether they are identical or not.

109. *Linyphia vivax.*

Linyphia vivax, Blackw. Linn. Trans. vol. xviii. p. 657; Walck. Hist. Nat. des Insect. Apt. t. iv. p. 499.

Both sexes of this spider, which bears a striking resemblance

to *Linyphia cauta,* were discovered in the greenhouse and melon-pits belonging to Mrs. Darbishire, of Green Heys, near Manchester, in September 1836.

In the account of *Linyphia vivax* given in the eighteenth volume of the 'Transactions of the Linnæan Society,' a doubt is implied as to its being distinct from the *Linyphia globosa* of M. Wider (Museum Senckenbergianum, B. i. p. 259. taf. 17. fig. 9); however, having attentively perused the description and inspected the figure of the latter, I am now thoroughly convinced that they are different species.

110. *Linyphia socialis.*

Linyphia socialis, Sund. Vet. Acad. Handl. 1832, p. 160.
—— *annulipes,* Blackw. Lond. and Edinb. Phil. Mag. Third Series, vol. iii. p. 348; Research. in Zool. p. 398.

I concur entirely in the opinion communicated to me by Professor Sundevall (private letter), that *Linyphia socialis* and *Linyphia annulipes* are identical; the former name therefore, imposed upon this species by the Professor, must take precedence of the latter.

This spider, which occurs in autumn on the trunks of trees in woods at Oakland, M. Walckenaer has portrayed in his 'Hist. Nat. des Insect. Apt.' pl. 21. fig. F. 2 D, under the name of *Théridion gonflé*; but has prefixed to his description of it, t. ii. p. 274, the appellation of *Linyphia bucculenta,* conferred by Professor Sundevall on a very different species; namely on that designated *Linyphia reticulata* by M. Walckenaer (Vet. Acad. Handl. 1831, p. 109).

111. *Linyphia cripticolens.*

Linyphia cripticolens, Walck. Hist. Nat. des Insect. Apt. t. ii. p. 275.
—— *nebulosa,* Sund. Vet. Acad. Handl. 1829, p. 218.
—— *pallidula,* Blackw. Research. in Zool. p. 403.

When my attention was first directed to this spider in the summer of 1834, I perceived that it possessed the essential characters of a *Linyphia,* and described it in my 'Researches in Zoology' as new to science, under the specific name of *pallidula,* not being aware that M. Walckenaer had included it among the *Theridia,* in his 'Tableau des Aranéïdes,' p. 75, or that Professor Sundevall had described it previously, having, at that time, no opportunity of consulting his excellent publications in this department of zoology.

Linyphia cripticolens is found in North Wales under stones, and in cellars, vaults, and other obscure damp places. In June or July the female constructs a globular cocoon of yellowish brown silk of a loose texture, measuring $\frac{1}{6}$th of an inch in dia-

meter; it is commonly attached to her spinners by fine lines, and contains about 98 spherical eggs of a brown colour, not adherent among themselves.

112. *Linyphia alticeps.*

Linyphia alticeps, Sund. Vet. Acad. Handl. 1832, p. 261.
—— *luteola,* Blackw. Lond. and Edinb. Phil. Mag. Third Series, vol. iii. p. 192; Research. in Zool. p. 390.

The conclusion arrived at by Professor Sundevall, that *Linyphia alticeps* and *Linyphia luteola* are the same species, is perfectly correct (private letter); but M. Walckenaer is certainly mistaken in regarding it as identical with his *Argus cornutus* (Hist. Nat. des Insect. Apt. t. ii. p. 368), from which it differs remarkably in structure, colour, habits and œconomy.

I have procured specimens of this interesting *Linyphia* in Lancashire and Denbighshire, and Mr. R. H. Meade has taken it in Yorkshire. The male has the palpal organs fully developed in autumn, at which season both sexes are plentiful in the plantations about Crumpsall Hall, near Manchester, constructing snares of moderate extent among coarse grass beneath the trees. Like other species of the genus, they are usually seen on the under side of the horizontal sheet of web in an inverted position.

113. *Linyphia longidens.*

Linyphia longidens, Wider, Museum Senckenb. B. i. p. 270. taf. 18. fig. 5; Walck. Hist. Nat. des Insect. Apt. t. ii. p. 264.
—— *tardipes,* Blackw. Lond. and Edinb. Phil. Mag. Third Series, vol. viii. p. 488.

On obtaining a copy of the first volume of the 'Museum Senckenbergianum,' I immediately perceived that *Linyphia longidens* and *Linyphia tardipes* are specifically the same. See the synonyma.

This spider is found in Denbighshire, Yorkshire, and Lancashire under stones and detached pieces of rock, and in December 1848 Mr. J. Hardy forwarded an adult female to me from Berwickshire. It pairs in August and September, and the female fabricates several cocoons of white silk of a fine but compact texture, which she attaches to the inferior surface of stones by a small web; they are flat on the side in contact with the stones, and convex, with a depressed margin, on the opposite side. The largest of these cocoons measures $\frac{1}{4}$th of an inch in diameter and contains about 40 spherical eggs of a pale yellow colour, not agglutinated together, but enveloped in delicately soft silk. The snare of this species consists of a small, compact, horizontal sheet of web constructed in cavities beneath stones, on the under side of which it takes its station in an inverted position. In the dis-

position and relative size of its eyes an approximation to the *Theridia* may be traced.

114. *Linyphia frenata.*

Linyphia frenata, Wider, Museum Senckenb. B. i. p. 269. taf. 18. fig. 4; Walck. Hist. Nat. des Insect. Apt. t. ii. p. 279.
—— *pallida*, Blackw. Linn. Trans. vol. xix. p. 126.
Theridium pallidum, Koch, Die Arachn. B. iii. p. 64. tab. 94. fig. 216.

Not perceiving that the *Theridium pallidum* of M. Koch is identical with the *Linyphia frenata* of M. Wider, M. Walckenaer has included it among the synonyma of *Theridion sisyphum* (Hist. Nat. des Insect. Apt. t. ii. p. 299).

In autumn this rare species spins among grass growing in the grounds about Oakland an extensive horizontal sheet of web supported by fine lines united to its superior surface and to each other at various angles, and attached by their upper extremities to objects situated above it. Like its congeners, it takes its station on the under side of the web in an inverted position, and there watches for its prey. Mr. R. H. Meade transmitted to me an adult male *Linyphia frenata* from Yorkshire in 1851.

115. *Linyphia tenuis.*

Linyphia pusilla, Blackw. Research. in Zool. p. 392.

I have been under the necessity of changing the specific name of this spider, the appellation of *pusilla* having been previously conferred on a small Swedish *Linyphia* by Professor Sundevall (Vet. Acad. Handl. 1829, p. 214).

Linyphia tenuis is of frequent occurrence among grass and under stones, and is widely distributed in England and Wales.

116. *Linyphia insignis.*

Linyphia insignis, Blackw. Linn. Trans. vol. xviii. p. 662; Walck. Hist. Nat. des Insect. Apt. t. iv. p. 499.

A single adult female of this species was sent to me from Lancashire in the autumn of 1837 by Mr. John Parry, who captured it at Trafford, near Manchester; and in 1851 two adult females and an immature male which had to undergo its final change of integument were submitted to my inspection by Mr. R. H. Meade, who informs me that he found them on the fronds of fern growing in woods near Bradford in Yorkshire.

117. *Linyphia nigella.*

Linyphia nigella, Blackw. Lond. and Edinb. Phil. Mag. Third Series, vol. viii. p. 487.

Specimens of *Linyphia nigella* were found under fragments of

rock in woods at Oakland, in September 1835; they were all males, and had the palpal organs completely developed.

118. *Linyphia pulchella.*

Linyphia pulchella, Blackw. Ann. and Mag. Nat. Hist. vol. xviii. p. 301.

An adult male of this *Linyphia* was discovered among grass in a pasture at Oakland in September 1845.

119. *Linyphia furva.*

Linyphia furva, Blackw. Linn. Trans. vol. xviii. p. 663.

In May 1838 both sexes of this spider were detected under stones in a moist pasture at Oakland.

120. *Linyphia Claytoniæ.*

Linyphia Claytoniæ, Blackw. Linn. Trans. vol. xviii. p. 664; Walck. Hist. Nat. des Insect. Apt. t. iv. p. 499.

I am indebted to Miss Ellen Clayton for the only specimens of this species which I have seen; they were two adult males, captured near Garstang in Lancashire.

121. *Linyphia obscura.*

Linyphia obscura, Blackw. Linn. Trans. vol. xviii. p. 665; Walck. Hist. Nat. des Insect. Apt. t. iv. p. 499.

Males of this spider, having the palpal organs fully developed, were taken in June 1836 on rails at Oakland.

122. *Linyphia gracilis.*

Linyphia gracilis, Blackw. Linn. Trans. vol. xviii. p. 666; Walck. Hist. Nat. des Insect. Apt. t. iv. p. 499.

Mature males of *Linyphia gracilis* were found on rails near Crumpsall Hall in November 1836.

Genus Neriëne, Blackw.

123. *Neriëne marginata.*

Neriëne marginata, Blackw. Lond. and Edinb. Phil. Mag. Third Series, vol. iii. p. 188; Research. Zool. p. 363. pl. 3. fig. 6, 7.

This species constructs snares, similar in design to those of the *Linyphiæ,* among grass growing in and near woods in Lancashire and Denbighshire. I have also inspected specimens which were taken in Devonshire by Miss Ellen Clayton in 1845, and others captured in Yorkshire by Mr. R. H. Meade in 1851. The sexes arrive at maturity in autumn, and are sometimes abundant in localities suited to their habits. If this spider be com-

pared with *Linyphia marginata,* it will immediately be seen how easy the transition is from the genus *Linyphia* to that of *Neriëne.*

124. *Neriëne bicolor.*

Neriëne bicolor, Blackw. Lond. and Edinb. Phil. Mag. Third Series, vol. iii. p. 344; Research. in Zool. p. 366.

Neriëne bicolor is common in many parts of England and Wales. It appears to prefer well-wooded districts, constructing among grass a snare similar to that of *Neriëne marginata.* Not unfrequently it may be found on rails or concealed under stones partially imbedded in earth. The male has the palpal organs developed in autumn.

125. *Neriëne rufipes.*

Neriëne rufipes, Blackw. Lond. and Edinb. Phil. Mag. Third Series, vol. iii. p. 345; Research. in Zool. p. 368.

Specimens of this spider were obtained in 1832 under stones and on rails in the township of Crumpsall. In June the female fabricates several globular cocoons of yellowish white silk of a slight texture, which she attaches to the inferior surface of stones; the largest of them measures $\frac{1}{6}$th of an inch in diameter, and contains about 50 spherical eggs of a yellowish white colour, not adherent among themselves.

126. *Neriëne livida.*

Neriëne livida, Blackw. Lond. and Edinb. Phil. Mag. Third Series, vol. viii. p. 486.

Mr. J. Hardy forwarded to me from Berwickshire, in December 1848, an adult male of this species, which is plentiful in the valley of the Conway, where it conceals itself under stones. In July the female spins several globular cocoons of white silk of a slight texture, attaching them to some depression in the stone selected for her retreat; the largest of these cocoons measures $\frac{1}{7}$th of an inch in diameter, and comprises about 30 spherical eggs of a pale yellowish white colour, not agglutinated together.

127. *Neriëne furva.*

Neriëne furva, Blackw. Lond. and Edinb. Phil. Mag. Third Series, vol. viii. p. 486.

One adult male is the only specimen of this spider that I have seen; it was discovered under a fragment of rock in a wood at Oakland in June 1835.

128. *Neriëne errans.*

Neriëne errans, Blackw. Linn. Trans. vol. xviii. p. 643.
Argus errans, Walck. Hist. Nat. des Insect. Apt. t. iv. p. 511.

Neriëne errans is not uncommon among grass and on rails in North Wales and in the south of Lancashire.

129. *Neriëne sylvatica.*

Neriëne sylvatica, Blackw. Linn. Trans. vol. xviii. p. 644.

Adult males of this species were taken in February 1837 under detached pieces of rock, slightly imbedded in earth, in woods about Llanrwst.

130. *Neriëne viaria.*

Neriëne viaria, Blackw. Linn. Trans. vol. xviii. p. 645.
Argus viarius, Walck. Hist. Nat. des Insect. Apt. t. iv. p. 512.

A male of this spider, which had the palpal organs perfectly developed, was found running on a footpath at Oakland in May 1838.

131. *Neriëne pulla.*

Neriëne pulla, Blackw. Linn. Trans. vol. xviii. p. 646.
Argus pullus, Walck. Hist. Nat. des Insect. Apt. t. iv. p. 512.

Males of *Neriëne pulla,* in a state of maturity, were captured in June 1836 on rails near Llanrwst.

132. *Neriëne gracilis.*

Neriëne gracilis, Blackw. Linn. Trans. vol. xviii. p. 646.
Argus gracilis, Walck. Hist. Nat. des Insect. Apt. t. iv. p. 512.

Both sexes of this species were taken on rails at Crumpsall Hall, and at Capel Garmon, in the parish of Llanrwst, Denbighshire, in the autumn of 1836.

133. *Neriëne vagans.*

Neriëne vagans, Blackw. Research. in Zool. p. 374.

This is an aëronautic spider, and is very common among the grass of meadows and pastures in North Wales and in Lancashire.

134. *Neriëne pygmæa.*

Neriëne pygmæa, Blackw. Research. in Zool. p. 376.

Neriëne pygmæa is plentiful among the grass of old pastures in Lancashire and North Wales, and may frequently be seen running on rails and on footpaths.

135. *Neriëne lugubris.*

Neriëne lugubris, Blackw. Research. in Zool. p. 380.

In June 1834 I captured adult males of this species on iron rails at Crumpsall Hall.

136. *Neriëne saxatilis.*

Neriëne saxatilis, Blackw. Annals and Mag. of Nat. Hist. vol. xiii. p. 183.

A male of this *Neriëne,* having the palpal organs fully developed, was discovered among loose fragments of rock in a wood at Hendre House, near Llanrwst, in June 1841.

137. *Neriëne avida.*

Neriëne avida, Blackw. Annals and Mag. Nat. Hist. vol. xiii. p. 185.

Males and females of this spider were found on rails at Oakland in April 1839.

138. *Neriëne timida.*

Neriëne timida, Blackw. Annals and Mag. Nat. Hist. vol. xiii. p. 183.

Both sexes of this species were taken on rails at Oakland in April 1841.

139. *Neriëne flavipes.*

Neriëne flavipes, Blackw. Annals and Mag. of Nat. Hist. vol. xiii. p. 182.

In February 1841 adult males of *Neriëne flavipes* were captured on rails at Oakland.

140. *Neriëne parva.*

Neriëne parva, Blackw. Linn. Trans. vol. xviii. p. 647.
Argus minimus, Walck. Hist. Nat. des Insect. Apt. t. iv. p. 512.

Specimens of this very minute spider were detected on rails at Oakland in January 1837; they were all males, and had the palpal organs perfectly developed.

IV.—*Upon the Development of Mollusks in* Holothuriæ. By Prof. Müller*.

In the Bay of Muggia, at Trieste, a *Holothuria* of the genus *Synapta* is very abundant. It was first discovered by Montague upon the English coast, and was by him called the *Holothuria digitata,* and so much of its anatomy as could be made out from specimens preserved in spirits has been set forth in the 'Anatomische Studien über die Echinodermen†.' In the living *Synapta digitata* I first discovered those suckers upon the tentacles, which Quatrefages had described in another *Synapta,* and some other anatomical peculiarities not observed by that writer,

* Read before the Royal Academy of Sciences of Berlin, Oct. 16, 1851.
† Müller's Archiv, 1850.

such, for example, as the muscular stomach, the muscular bundles in the mesentery (with whose movements Quatrefages was acquainted), and the existence of many peculiar ciliary organs, $\frac{1}{20}$th of a line in length, attached to the mesentery, the general surface of which is not ciliated.

The pedicles of these organs have the same structure as the peritoneum, consisting of a simple glassy membrane in which nuclei are scattered, and which is continued over the outer surface of the organs. The structure of these organs is complicated, and could be more readily explained by figures than by any description; to call them slipper-shaped, or like a cornucopia, would perhaps give the best general idea of their outward form and of their cavities clothed with long active cilia.

When at the commencement of the present year I had an opportunity of procuring this *Synapta digitata* in great numbers at Trieste, I found ova in all the individuals, whence the statement of Quatrefages, that these animals are hermaphrodite, seemed confirmed; a circumstance which surprised me no little, inasmuch as the other families of Echinoderms are without exception diœcious.

In summer, when I renewed my investigations at the same place, I found the several organs of almost all in nearly the same condition as in spring, but less turgid.

The ova were about $\frac{1}{22}$ to $\frac{1}{30}$ of a line in diameter; in spring they measured as much as $\frac{1}{17}$th of a line. The yelk is very finely granulous, and contains a germinal vesicle—which has no germinal spot such as Quatrefages depicts. The dichotomously branched ovarium is rendered yellow by the ova; its innermost layer was formed as in spring by cells $\frac{1}{400}$th to $\frac{1}{260}$th of a line in diameter, from which, according to Quatrefages, the spermatozoa are developed.

About the middle of August I met for the first time with an individual with a totally different generative organ. This was much thicker and unbranched, of a green colour for one moiety of its length, while the other was orange; the latter portion contained ova with a germinal vesicle, and without any germinal spot, but they were larger ($\frac{1}{13}$th line), and very different in appearance; their yelk was coarsely granular, the granules being partly round and partly oval, dark-coloured, and having the appearance of the so-called stearine-granules of the frog's ovum: they were $\frac{1}{400}$ to $\frac{1}{200}$th of a line in diameter.

When I observed this, I began again to doubt the hermaphrodism of the *Synaptæ*, and I conceived that either these, or the other more numerous individuals, must be the males; I therefore caused great numbers of *Synaptæ* to be brought to me daily, and soon found individuals similar to those last described; but to

my infinite astonishment, while in one individual I found in the anomalous genital organ, sacs containing ova undergoing the process of yelk-division, in another the same organ contained similar vesicles in which young mollusks with spiral shells $\frac{1}{10}$th of a line in diameter were included.

This was the commencement of the researches which I continued uninterruptedly for two months, and in the course of which I observed sixty-nine times the occurrence of mollusks or mollusk-yelks in this *Holothuria*.

The individuals which contain mollusks agree in all respects with the normal individuals of *Synapta digitata*; they possess the same twelve four-fingered tentacles, the same structure of the integument, the same calcareous plates and "anchors" to which their adhesive power is due. Another kind of *Synapta*, the *S. inhærens*, occurs also, but more rarely, in the Bay of Muggia; it is however certain, that all I have to say concerning the production of mollusks in *Holothuriæ* relates to *S. digitata*.

The *Synaptæ* were taken at a depth of from 6–8 fathoms in fine mud not far from Muggia, and were regularly brought to me every day from Zaole*. These *Synaptæ*, like all their congeners, have the habit of breaking up spontaneously when roughly handled, and were not to be obtained in an entire state; the daily supply therefore consisted of fragments of *Synapta* which had a maximum length of 8 to 10 or 12 inches. Among them anterior portions with the head were to be found.

The head once separated, the fragments, however long they may be, do not break up again, but remain living and moving for a day or more; a piece with a head, however, redivides as often as it is irritated, and it is only by longitudinally dividing the head that this process can be finally stopped.

It is, hence, impossible for me to say exactly how long the *Synapta digitata* is, but I estimate its length at 15 to 20 inches. From the same cause also, it is impossible to determine with any certainty, what is the proportion of individuals with molluskigerous organs to those with normal ovaria. All that I could do was to put the various fragments of my daily collection together and measure the whole. In this manner a conception may be formed upon how large a mass of materials the labours of these two months were expended. On one day when the quantity of the worms was less than usual, the length of the fragments, placed end to end, was 60 feet; on another occasion when there were more, it was 79 feet. In so large a mass of fragments one readily found 15 to 20 short pieces with heads, and a still greater number with normal ovaria; at times, though rarely,

* The fisherman was Mattia Frusing of Zaole.

there were no molluskigerous individuals; generally, however, there was one, two or three, and sometimes even four such. These were neither larger (or older) nor smaller (or younger) than the others—young and old were found of each kind.

The individuals with normal ovaria never possessed the unbranched molluskigerous organ, and those possessing the latter organ were never provided with the ordinary branched ovarium of *Synapta*.

The molluskigerous individuals may be very easily distinguished externally from the others, the semitransparency of the body permitting us readily to see whether it contain the common ovarium or the thick molluskigerous organ.

On the spontaneous fission of these animals, it of course readily happens, that the generative organs, which open externally at the head end, become torn, and are found partly in the separated head-portions, partly in the headless fragments. In the same manner the molluskigerous organ is found, either torn from its connexions, and lying loosely coiled up in the abdominal cavity; or still attached to, and in organic connexion with, the *Synapta*. I have so frequently observed this organic connexion (twenty times), that it is beyond doubt, and must be supposed to exist in all cases. The connexion is a double one—by both ends; the ordinary ovaria are attached only to the head, where they open, while in the opposite direction they float perfectly free in the abdominal cavity; but the molluskigerous organ when uninjured is attached not only to the head where it opens externally, but by its lower end to the intestine in the manner to be described immediately. There may be from one to three molluskigerous sacs in the same individual.

The structure of this molluskigerous one nowise resembles that of the ordinary generative organs. The tube is uninterruptedly continuous throughout, but is differently coloured in its two halves. The portion attached to the intestine is always green, the other is coloured yellow by its contained yelks. So far as the sac is green, it contains an intus-suscepted portion of itself, with a blind end, like the inverted finger of a glove; and at the point of intus-susception it is connected with the intestine, or rather with the intestinal blood-vessel, which gives off a branch to invest the open end of the intus-susception. The mode of this connexion is very extraordinary. Where the sac is embraced by the vessel it is enlarged into a sort of knob, from the middle of which the involuted portion passes into the interior of the sac. The open mouth of the cavity of this portion therefore projects into the cavity of the blood-vessel, and the blood not merely bathes the knob, behind which walls of the vessel are attached to

those of the sac, but the blood must also penetrate into the cavity of the intus-suscepted portion as far as its blind end.

There are two intestinal vessels, as in other *Holothuriæ*; both are very capacious, and they lie one on the free side of the intestine, the other along the line of attachment of the mesentery.

It is always the former which is connected with the molluskigerous sac, and the mode of connexion is always the same. The place at which the attachment takes place is anteriorly, a short distance (at the most $1\frac{1}{2}$ inch) behind the muscular stomach possessed by the *Synaptæ* in common with many *Dendrochirotæ*. If there be two sacs, they are attached one behind the other in just the same manner.

The two intestinal vessels present under the microscope violent undulating contractions of their walls, such as may be seen in the intestinal vessels and vascular plexuses of *Holothuria tubulosa*.

The undulatory movement is continued on to the vascular branch which invests the knob of the molluskigerous sac. There is no ciliary motion in the interior of the intestinal vessels, the blood-corpuscles rolling hither and thither only in consequence of the undulatory contractions; on the other hand, the vessels and the intestinal walls are ciliated upon their outer surface, and this ciliary investment is continued on to the outer surface of the vascular branch which invests the "knob," but it stops short where the wall of the vessel unites with that of the sac, and the latter has no cilia upon its outer surface. In this it is distinguished from the ordinary ovarial sacs of the *Synapta*, for these are externally ciliated.

The mollusks are not produced within that portion of the sac which contains the intus-susception, but in the other part. In this more capacious portion, both the male and the female elements of the mollusks, and subsequently the mollusks themselves, are found. The organ which contains the female elements may be called an ovarium, and that which contains the male elements may be called a testis, but in structure they have no resemblance whatever to ordinary testes or ovaria; their products however are identical with the ova and spermatozoa of other animals. Both ovarium and sperm-sacs lie free within the molluskigerous sac, and are in no way attached to it. The ovary lies next to the intus-susception, and thereupon follow the numerous sperm-sacs; but before describing these, it will be necessary to enter into the minute structure of the walls of the molluskigerous sac.

The outer layer of this sac and the inner of the intus-susception consists of perpendicular elongated (palisaden-förmig) cells, from whose contents the green colour of the green portion arises, for they contain yellowish granules which in the green part are

more richly developed, and here form complete series in the cells. Similar cells, however, everywhere form the outer layer. Below these lies the muscular membrane, consisting of transverse and longitudinal fibres, on which the slow worm-like movements of the sac, which may commonly be observed, depend. Internal to this muscular coat perfectly transparent cells are scattered. The innermost layer is formed by a membrane which presents a lively ciliary motion everywhere—save in the green part. It is in this ciliated part of the sac that the ovarium and the sperm-sacs lie perfectly free, like the charge in a gun.

The ovary again has its peculiar investment. This is a long tubular capsule, everywhere closed and ciliated upon its whole surface. The ciliated inner surface of the sac therefore is turned towards the ciliated outer surface of this capsule of the ovary.

The ovarian capsule is for the most part, but not wholly, filled by the ovary. The end which is turned towards the intus-susception of the sac is always empty and much thinner than the other part of the capsule, and this thinner end is always bent back upon itself, so that not its end, but its knee-shaped bend, is in contact with the extremity of the green intus-susception.

It is here that the structure of the capsule may best be made out. Beside the ciliated membrane there is an internal layer of small elongated cells with scattered clear globules about $\frac{1}{160}$th of a line in length. In all the rest of the capsule, so far as it is filled by the ovary, scattered agglomerations of yellow fat granules may be perceived upon its inner surface between it and the ovary.

The orange-coloured ovary lies in the capsule, but does not follow its shape. It is dendritic, so that the capsule passes over the branched mass; and in an ovary which is not quite fully-formed, little clear gaps may be observed here and there between the branches of the ovary. The dendritic figure is that of a central stem, from which branches are given off on each side and divide and subdivide.

The central stem lies against the inner surface of the ovarian capsule, so that in the imperfectly developed ovary, a hollow space exists within the capsule which disappears in the course of further development. If the capsule be carefully opened, the ovarium may be extracted and its structure further examined. It consists, in all its parts, of egg-like masses $\frac{1}{17}$th of a line in diameter, inclosed in membranes; the contents are coarse stearine-like yelk-granules (of $\frac{1}{200}$ to $\frac{1}{400}$ of a line in diameter), and a germinal vesicle of $\frac{1}{30}$th of a line in diameter without a germinal spot. The germinal vesicle is viscid throughout, and is more similar to what Von Baer calls the " nucleus of the ovum " in the perfect ova of *Echinus*. The yelk-granules are frequently aggregated

into small round masses, and among them are found many excessively minute particles which exhibit the molecular motion. The yelk-granules are for the most part naked; a few of the larger ones are however surrounded by an albuminous area such as has been remarked in the ova of sharks and frogs. The ova cannot be separated from one another; on pressure, their membranous investment bursts, and some become no longer round, but elongated or pyriform; it would appear, that the membrane investing the yelks belongs rather to the ovarian capsule, which it serves to divide into compartments, and that the ovum has no proper vitellary membrane. The ovum which has left the ovarium has certainly no vitellary membrane, in this respect resembling the ovum of *Actæon* as described by Vogt. When the ovary is perfectly developed, it and its capsule dehisce, and give exit to the ova which thus are found within the molluskigerous sac. Here fifteen to thirty together become invested by a common vesicle, and these vesicles occupy partly that portion of the sac which follows the ovary, partly the space between the capsule of the ovary and the sac.

Under these circumstances the development of the mollusks commences, and is first recognizable by the occurrence of the phænomena of yelk-division. For a long time, with so much else that was incomprehensible, I was unable especially to comprehend how it was that the yelks began at once to develope their embryos, since as a general rule the division-process arises as a consequence of fecundation, and is never observed in gemmæ.

Towards the beginning of September, however, I discovered the fecundating organs of the mollusk-ova in the same sac which contains the ovarium with its capsule.

There are generally many sperm-capsules present; in most cases there are four to five or eight, and there may be as many as eighteen. They lie perfectly free in a rather wide portion of the molluskigerous sac, not far from the ovary and somewhat nearer to its aperture.

The sperm-capsules are elliptical bodies $\frac{1}{8}$th to $\frac{2}{5}$ths of a line in diameter, which are not ciliated upon their surface. Each consists of two membranous sacs, one inclosed within the other; the outer is the larger, and projects beyond the inner anteriorly and posteriorly. An epithelial layer lines the simply membranous outer sac, and between it and the inner sac there are clear cell-like globules of different sizes, together with solitary and aggregated yellow fat-granules, like those of the ovarian capsule. The internal sac is a perfectly transparent, simple, structureless membrane, though I have repeatedly observed sudden contractions of its walls under the microscope. Its inner surface is clothed with a layer of cells $\frac{1}{200}$th of a line in diameter,

which seem to take part in the development of the spermatozoa. With these latter the whole capsule is filled; they are partly united into moving bundles by their heads, and partly they swim about separately. Their heads are sometimes rounded, sometimes elliptical, not uncommonly somewhat pointed anteriorly; the tail is very long, and at times seems to be the prolongation of a sort of ridge upon the head. The end of the tail always presents a longish enlargement. The head is about $\frac{1}{400}$th of a line in diameter; the whole spermatozoon $\frac{1}{30}$th of a line or more.

I have so often (eight times) observed the sperm-capsules, that their occurrence is perfectly certain. They are found for the most part only in those sacs which do not contain free and fecundated ova, but I have also found them in sacs in which the mollusks had commenced their development.

In these, however, some remains of the ovary are always to be found.

The spermatozoa may become free by the dissolution of their capsules. I have seen them free in a single case; here they whirled about in great quantities in the ciliated sac round the ovary close to its inner end, that is to say, as far as possible from the place of their development in the neighbourhood of its outer end.

The development of the mollusks from these yelks proceeds thus: in those sacs in which the contents of the ovary have already passed into the common sac, we find the developing germ mass always inclosed in vesicles of $\frac{3}{10}$, $\frac{4}{10}$ to $\frac{6}{10}$ of a line in diameter, which are developed with the sac. Each vesicle will contain fifteen to thirty or more germs, or already developed mollusks. If the germs be not yet developed into mollusks, the characteristic yelk-granules are immediately recognizable in the yelk, together with the germinal vesicle and the finely granular mass with molecular motion of which it was composed in the ovary. Even in the interior of the mollusks, the remnants of the yelk possess the same characteristic yelk-granules.

I have seen the germ mass within the vesicles in the following states:—

1. In every vesicle (there may be more than 100 of them in the sac) there are no single yelks or germs, but the yelk-mass is quite diffused; many round masses of yelk-granules may indeed exist in it, as in the ovary, but these are much smaller than the pre-existing yelks of the ovary. The germinal vesicles, answering in number to the embryos to be formed in the vesicle (therefore some fifteen to thirty), are scattered through its contents and have still the same constitution and size as in the ovary. Those vesicles in which the yelk-mass is in this finely divided condition always have a white appearance; the yelk-granules are still as in

the ovary, but the number of those which present an albuminous area has very much increased, and the area is proportionally larger. This stage has been observed seven times.

2. In each vesicle are fifteen to thirty separate yelks of $\frac{1}{13}$th of a line in diameter, each containing a germinal vesicle. In this state the yelks always appear of an orange colour as in the ovary. Either no traces remain of the diffused yelk-mass, or at times some of its granules and granule-aggregations are left unappropriated. This stage was observed five times.

3. In every vesicle there are fifteen to thirty separate yelks, which have begun to divide, *e. g.* all the yelks consist of four globular masses. This stage was observed eleven times.

4. All the yelks of a vesicle have developed a ciliated cortical or embryonic layer. Observed six times.

5. In every vesicle, fifteen to thirty embryos of mollusks with shells are contained. Observed seventeen times. In such a brood as this, some 2400 mollusks come into the world. They all possess a calcareous shell about $\frac{1}{10}$th of a line in diameter, more or less, which effervesces with acids; they have an operculum upon the foot, and a respiratory cavity similar to that of the Pectinibranchiata, which are well known to be all unisexual.

For a long time I did not know how the mollusks made their way out of the *Synapta*, because I could procure no head portion with the outer end of the sac; for when the *Synapta* breaks up, the sac commonly remains in that part which separates from the head. Once, however, I had the good fortune to find a piece with the head in which not merely two molluskigerous sacs (one containing developed mollusks), and a third in a rudimentary state, were present, but where also the two larger sacs had suffered no injury at either their point of connexion with the intestinal vesicle, or at that where they opened externally.

The third sac was easily distinguishable by its structure from the vesicula Poliana, the walls of which contain the same elongated calcareous discs as the integument of the tentacles. In this still very small sac, the ovarian capsule with its bent end was readily distinguishable; its external end was firmly connected with the place of opening of the two other sacs, but the other end was free.

The facts of which I have now given an accurate, though a very general account, differ so widely from the ordinary course of things, that I should myself place no credence in them, had they not almost daily been forced upon my notice. The first complete account of them is now before the Academy, for until the present time I have only communicated them orally in Trieste to a few naturalists, to M. Heckel of Vienna, to Prof. Boeck of Christiana, and to Prof. R. Wagner of Göttingen. I consider it

a most fortunate circumstance that one of the most celebrated physiologists of the day was working for a considerable time, with a few of his pupils, in Trieste, so that I was enabled to demonstrate the most important of the phænomena in question to him. I have opened the *Synaptæ* in the presence of Prof. Wagner, and he could see for himself that the molluskigerous sac was connected with the intestine, or rather with its vessel. I could further show him this sac in two conditions: first, while still containing the ovarium; secondly, when the contents were the vesicles with living mollusks, in which the motion of the otolithes was very beautifully visible. I was also fortunate enough to be able to demonstrate to M. Wagner the sperm-capsules with their moving spermatozoa. My son has likewise observed all the more important facts.

The development of the mollusks from the yelk closely resembles that of other mollusks, *e.g. Actæon* (according to Vogt's observations). As in this, there is no vitellary membrane, and two kinds of spheroidal masses are formed by the process of yelk-division, viz. large opake masses, with many yelk-granules, and smaller more transparent spheroids, which also contain stearine-granules, and finely granular molecular masses, but in smaller quantity; in addition these have their small clear nucleus. In some respects, however, the process of division is peculiar. Before the division of the yelk into two masses takes place, and in yelks which are still quite round, that of the germinal vesicle or clear nucleus occurs. In such round fecundated yelks we find, instead of the germinal vesicle, two somewhat smaller, but otherwise quite similar bodies. Besides, the germinal vesicle does not disappear at all, but in the course of yelk-division is used up to form the clear bodies in the interior of the division-masses. It is perfectly similar in the ovarian ovum and in the fecundated ovum. In the vesicles containing yelks, we find both such as are perfectly spherical and such as begin to show a division; this commencing division I regard as the indication that the fecundation of all the yelks which are contained in the vesicle has taken place, but yet all still contain the germinal vesicle, and it is either of the same size as in the ovarian ovum and possesses the same viscidity, or there are two smaller ones which must have proceeded from its division. When yelk-division sets in, first two and then four large yelk-spheroids are formed, each of which has its clear, central nucleus. When the four large spheroids exist, four small transparent spheroids are seen at the intersection of the lines of division upon one side; these soon become divided into eight, sixteen and more, the four large opake spheroids remaining unchanged.

In the small transparent yelk-spheroids, the stearine-granules

appear very soon to break up and become dissolved. The four large spheroids are even yet present when the whole surface of the yelk has become invested with a layer of transparent cells, and when the moving cilia are developed upon these. The four large spheroids thus remain in the interior of the yelk, and only become more closely appressed, remaining otherwise unchanged superficially. If however they be crushed at the time when the cortical layer of the yelk is already developed and begins to exhibit ciliary motion, we find in their interior a great number of clear nuclei, and I enumerated as many as twelve or more of these simply inclosed within the large spheroids. It follows then that the division of the clear nucleus of a yelk-spheroid precedes the division itself in our mollusks.

The greater number of my observations relate to the period when the mollusks contained in the sacs were almost perfect, and possessed a spiral shell of one turn and a half, out of which they could protrude themselves and into which they could retire. The shell resembles that of *Natica* more than any other, but the aperture is as long as it is broad. By the friendly aid of the Director, M. Koch, I was enabled to examine extensively the mollusks of the local fauna contained in the collection of the Zoological Museum of Trieste. The aperture of the shell is as large as the rest of the shell, or larger. The columella is almost straight, and thence the operculum has one edge more rectilinear. The shell appears also to be umbilicated. The body of the mollusk is, for the most part, made up of the richly-ciliated foot and head. The foot is transversely notched in the middle, and thence consists of two lobes, an anterior and a posterior, which carries the operculum. In the middle of the notch of the foot there is a kind of papilla with an aperture, in which a ciliary motion is perceptible, and which I can only interpret as an opening of the so-called water-vascular system. Above the anterior lobe of the foot is the mouth, which is covered by a peculiar, sometimes rounded, sometimes notched lobe. This lobe has much smaller cilia than the foot, and stiff immoveable cilia or hairs; whenever I observed them, these large cilia were motionless; like the lobes, they reminded one strongly of the cephalic velum of so many mollusk-larvæ, and perhaps at an earlier or a later period they are active. In this stage the young mollusks move about but little in the vesicles. Between the mouth and the foot there comes forth at times a peculiar, generally-hidden lobe, which possesses only short cilia, not larger than those upon the dorsal surface of the head. In the head we see the two auditory organs, vesicles, containing a constantly oscillating otolithe. Above this, upon the head, there are two short projections, the future tentacles; but no trace of the eyes is to be seen. Within the shell is the respiratory

cavity, a space which exists independently of the movements of the mollusk; within it, two series of long vibrating filaments are visible; one series runs longitudinally down the cavity of the shell, following its curvature, and then bending round towards the body of the mollusk; the second series runs in a more transverse direction. The mouth leads into a wide œsophagus, which passes above the two auditory organs. The stomach and intestine are similar to those of other young mollusks. The intestine forms a loop in the shell, whose returning limb, the rectum, bends to the right. The liver consists of relatively small cells. In the vicinity of the rectum, a few yellow granules may always be seen, like remnants of the yelk. The innermost part of the shell, nearer the apex, is filled by a transparent vesicular part of the body, which is penetrated by several thread-like cords, and thence appears vesicular. Yellow granules, similar to those just described, often lie among the threads, as if in the interspaces of vesicles. Sometimes the animals come out of their shells, and then the structure of this part is still clearer. In animals which have been freed by injury of the shell, or the like, the gill-cavity is torn, and the remains of the vibrating gill-filaments remain attached and uncovered.

The mollusks could be kept alive many hours by placing the vesicles containing them, or the sacs, in the abdominal fluid obtained by cutting open a *Synapta*. In the water they died sooner.

It would be extremely difficult to decide upon the exact zoological affinities of this mollusk. The presence of the operculum is not a character on which any great reliance can be placed, since mollusk-larvæ with deciduous shells, such as the Nudibranchiata and Tectibranchiata, possess one. But the possession of a respiratory cavity, the calcareous nature of the shell, the more developed spire, and its decidedly symmetrical curvature, seem to me to indicate that we have to do with one of the Pectinibranchiata. If, however, the shell of this mollusk be deciduous, the gill-cavity, which now extends far into the shell, must become wholly changed.

That the mollusks *are* developed within the *Holothuria* is clearly made out; how it is possible that they are so developed, I know not. All that I know is the fact, and the mode in which it occurs; and I may further add, that it is impossible the mollusks should have been introduced by any one from without. The *Holothuria* has not eaten them, for it eats nothing but fine earthy mud, and nothing else is ever found in its intestine; and even if it had, how could they get out of the intestine into the abdominal cavity and the molluskigerous sac? Neither have they crept into the abdominal cavity of the *Synapta*-fragments,

for all these are spasmodically contracted at their extremities, so that nothing can either pass from or into that cavity with its normally-contained saline fluid. Besides, how could a thousand or more mollusks creep in, particularly as they must have entered as yelks?

Neither have they crept into the sac from without, since they have arisen from their elements in it. It follows then that the sac must either itself be the equivalent of a mollusk, a vermiform metamorphosis of a mollusk as it were, which has made its way into the *Holothuria*; or it must be an organ of the *Holothuria*, which instead of *Holothuriæ* produces mollusks. If the molluskigerous sac be itself an animal, the intus-susception must be regarded as an intestine, the interior of the sac as an abdominal cavity, the ovarium and the sperm-sacs as the generative organs of the animal. The whole difficulty, however, does not consist in conceiving the sac to be an animal.

A grand difficulty for every theory is, that the molluskigerous sac is organically connected with the *Holothuria*. The knob-like end is not merely adherent by a sucker, or otherwise, to the *Holothuria* and its vessel, but the vessel of the *Holothuria* embraces and is grown to the knob of the sac.

Has this sac, then, perhaps arisen as a bud in the *Holothuria*, remaining in connexion with it, and perhaps having the same relation to the production of the mollusks as the proembryo of certain plants has to their production? Against this view, however, we have the fact, that the sac opens at the same place as the ordinary generative organs of the *Holothuria*.

Perhaps it is a case of the alternation of generations, the *Holothuria* producing mollusks, from which again *Holothuriæ* are produced, though it is highly improbable that the alternation of generations ever goes so far; and besides, the *Holothuria* has its own peculiar mode of reproduction, its own ova, with whose product indeed we are not yet acquainted, but which indubitably is wholly different from a mollusk, and without question is again a *Synapta*.

The mollusks are produced only in certain rare individuals of the *Holothuria*, which, instead of the normal generative organs, have others specially adapted for the production of mollusks.

Again, the essence of the alternation of generations is, that the form B, produced from, and dissimilar to, A, reproduces the form A. How would it be, however, if B propagated itself as B, and A as B, but also as A? Such a possibility had long since presented itself to my mind; and it seemed to me, that in the further development of the phænomena of alternation lay the possibility of an insight into the mode in which new forms have been introduced into the creation. From this point of view, then, the

newly-discovered facts might be regarded. They do not admit of further explanation, but must be considered as ultimate facts, by means of which many other phænomena, equally remote from the ordinary course, but equally unquestionable, may perhaps be explained. In the natural sciences, the inexplicable becomes by observation the basis of our explanations. The origin of different species in the creation is an indubitable fact of palæontology, but remains in the region of the supernatural so long as the very act of origin is not seen, and traced out into its elements. As soon as this is possible, it ceases to be supernatural, and falls among that higher order of phænomena, whose laws also observation will one day discover.

Whoso would give his imagination license to deduce a few further consequences from my observations, might thus speculate:—Till now it has been an idle question, whether the hen were created first or her egg; but from these observations it seems to follow that the egg had precedence, and further, that the semen of the cock existed before the cock. Further, might he say, that if the egg be primordial, the semen is contemporaneous with it. It is thence needless to suppose the origin of a double being consisting of male and female united, because we are led to suppose a primitive contemporaneous origin of males and females. From these observations, he would say, it is explicable how animals with separate sexes were created by the origin of ova and semen close together at the same place; they do not arise in the air, nor in the mud of the sea, but in an organ *ad hoc* within a pre-existing animal; and by means of an already present organic Artificer, who indeed for his own ends produces like from like, but also, obedient to a higher law, works in the history of creation according to laws of which we have as yet caught no glimpse.

Such might be the speculations of one who thought fit to make my observations a basis for the discussion of general metaphysical questions.

From my place as observer, I have simply to discuss all possibilities; but, as may be readily supposed, I repudiate all analogy between my observations and the theory of the equivocal generation of intestinal worms, which has long since taken its place in the category of errors. It is fortunate that these observations upon *Synapta* were not made sooner, since they might readily have disturbed the course of science, and have given origin to confused notions.

The discoveries of R. Wagner, Lovèn, Sars, Krohn, Van Beneden, and Dujardin, upon the production of Medusæ by Polypes, have been very generally explained by the alternation of generations, which certainly occurs, indeed, in the Medusæ

produced from *Strobila,* as described by Sars. For the young of *Medusa aurita, Cyanæa capillata,* and *Cephea Wagneri,* is in part polype-like, and the young of the two former multiplies by the production of larvæ, *i. e.* by means of budding and fission, before it attains the perfect sexual form. Some have believed, that, as a consequence, the class of Polypes and Medusæ must be united; and I was myself of the same opinion. Now, however, from my observations upon *Synapta,* and their necessary consequences, it would seem that these deductions have been pushed too far, and that we must draw a preliminary distinction between the alternation of generations and heterogony. The facts discovered by Sars belong to the proper alternation of generations. When the young *Medusa aurita* has a polype-like form, and fixes itself, it is by no means a Polype; it rather deserves the name of a Polype-like Medusa-larva.

As to the facts discovered by R. Wagner, Lovèn, Krohn, and Van Beneden, it is for the present uncertain whether they are cases of alternation or of heterogony.

For although the Polypes of the genera *Coryne, Syncoryne, Campanularia, Tubularia, Eudendrium,* produce by gemmation true Medusæ with gastric vessels, and even in part with the otolithe of Medusæ, yet no one has ever seen what sort of young these Medusæ produce, nor whether their sexual brood consists of Polypes of these genera.

On the other hand, the sexual propagation of these Polypes is already known. Lovèn has seen the ova of *Campanularia geniculata,* and the ciliated Polype-embryo which proceeds from them, and (which is still more important) has traced the development of the Polype from the latter.

The seminal organs of *Tubularia* and of *Eudendrium* have been discovered by Krohn and Kölliker, those of *Coryne squamata* by Rathke, those of *Campanularia geniculata* by Max. Schulze.

It follows, then, that these genera of Polypes produce two quite distinct generations, of which one is homogonous, the other heterogonous. The heterogonous products of those species of Polypes form a connected series of Medusæ, so that the homogonous and heterogonous generations of the Polypes form parallel series. Do different kinds of *Synaptæ* also possess heterogonous generations, do they produce mollusks, and do these also form parallel series?

The attention of naturalists must now be especially directed to the nature of the brood produced by those Medusæ which proceed from Polypes. The young, formed by gemmation, of a few allied Medusæ (Sars, Forbes), which I have myself observed, are again Medusæ; but do the former also produce similar Medusæ by their sexual generation?

Certain observations which I have made upon very young Medusæ show, at all events, that there exist very young Medusæ with all the attributes of a Medusa, which however move by embryonic ciliary motion only, and evince none of the pulsating contractions of adult Medusæ.

It seems to follow thence that they may be the result of sexual generation, and not of gemmation; for the ciliated young in Medusæ, as well as in Polypes, is the product of sexual generation.

Since, however, this ciliated young has already the form and organs of a Medusa, it appears to proceed directly from the Medusa itself; for the Medusæ proceeding from the buds of Polypes have no ciliary motion, and swim by the contraction of their umbrella.

To such forms as these belong the ciliated young of *Æginopsis mediterranea*, Nob., described by me in the 'Archiv' for 1851; and further, the young ciliated form described in the third Memoir upon the Echinoderm-larvæ, pl. 7. figs. 9–11, and whose nature, whether Echinoderm or Medusa, is there left undecided. Lately, in Trieste, I have determined it to be a young Medusa with otolithes; the auditory vesicles are pedunculated, and contain a round otolithe. A third young ciliated Medusa, with 6–10 unequal stiff marginal cirri, and 2–4 auditory organs with otolithes, was observed by me in Trieste. The number of the marginal cirri and pedunculated otolithe-sacs seems to increase successively in this young form. The otolithes are simple and round. The marginal cirri are divided by transverse partitions, as in *Polyxenia leucostyla* of Will, the young of which it probably is. The body of the animal is $\frac{1}{10}$th of a line in diameter.

From all this we may conclude, that there exist young Medusæ, with all the characters of Medusæ, in a very nearly embryonic state, swimming merely by means of cilia, and not arising by gemmation from Polypes, but very probably by direct sexual generation from certain Medusæ.

Observations on the preceding Article.

The well-known care and accuracy of Prof. Müller, and the lucid manner in which he has detailed his observations, render it impossible to entertain any doubts with regard to the *facts* which he has discovered, and of which we have above endeavoured to give an account as closely representing the original as the peculiarities of a foreign tongue would permit.

It is another affair, however, with regard to the *deductions* from those facts, and (supposing the whole evidence in Prof. Müller's possession to be before the public) we must confess to

being anything but convinced, that the Professor's conclusions are either necessary or even well-founded.

Prof. Müller considers that his discoveries have established the occurrence in *Synapta digitata* of what he calls "heterogony," or "heterogonous generation," that is, the production by a given species of offspring similar to itself, and of offspring dissimilar to itself, by true sexual generation; such offspring in each case being able to produce young like itself by sexual generation. Prof. Müller further points out, that this process is very distinct from the "alternation of generations;" and he suggests that it may explain the mode of the introduction of new species upon the surface of our planet.

There is of course no *à-priori* reason why this "heterogony" should not occur; but it is only reasonable to require that so novel and startling a theory should at least be based upon very strong evidence, and that the insufficiency of any attempt at a simpler method of explanation should be clearly demonstrated.

Now, we cannot think that Prof. Müller has done this. Take, for instance, a possibility which he himself suggests (only, however, summarily to dismiss again), that the molluskigerous sac may be the "equivalent of a mollusk—a vermiform metamorphosis of a mollusk as it were." How much might be said in favour of this supposition! The mode of development of very few mollusks is yet known, and their parasitism has been still less inquired into. Before the discoveries of Nordmann, who could have anticipated the extraordinary forms in which Crustacea are found parasitic? *Lernæocera* and *Pennella* are as little like crabs as the molluskigerous sac is like a mollusk.

Again, in considering the probability of a mollusk taking on a worm-like parasitic form, we must not forget that *Hectocotylus* is the male of the Argonaut, and yet that its form and habits led Cuvier to place it among the worms.

As to the "grand difficulty for every theory,"—the organic connexion of the sac with the *Holothuria*,—consider some cases of insect parasitism detailed by Dufour (Annals, Nov. 1851), in which there is an "organo-plastic" union between the stigmata of the parasite and those of the insect in which it dwells.

We do not, of course, offer such analogies as these, as in themselves an explanation of the facts observed by Prof. Müller, but merely to justify our belief that such an explanation may yet be found without recourse to the doctrine of "heterogony."

On one subject Prof. Müller appears to us to be decidedly in error; we mean in supposing that "heterogony" occurs among the Polypes and Medusæ. He says, "These genera of Polypes (i. e. *Tubularia, Eudendrium, Campanularia,* &c.) produce two

quite distinct generations, of which one is homogonous, the other heterogonous." Now we must distinctly deny that any such case as this occurs:—*There is no Polype yet known which has true generative organs and also produces Medusiform bodies.* It may have one or the other, but never both; and whenever the Medusiform bodies are developed, they represent the generative organs. Nor is there any case known in which (as in *Synapta*) certain individuals of a species of Polype possess generative organs producing Polype ova, while others develope Medusiform bodies.

It may be true that certain Medusæ arise from the ova of other Medusæ, but this is no evidence of heterogony; for we have no right to assume, as is commonly done, that all Medusæ proceed from Polypes by gemmation.

There is no evidence whatsoever in favour of the supposition that the ova of Polypes may become Medusæ, but the contrary. It must then be admitted, that if *Synapta* possesses this "heterogonous" generation, it stands alone as an instance of a physiological phænomenon without analogy or parallel in the animal kingdom.—Transl.

V.—*Notes on* Chalcidites, *and Descriptions of various new species.* By Francis Walker, F.L.S.

[Continued from vol. vii. p. 216.]

Megastigmus giganteus, Kollar MSS. *Flavus, vertice thoracisque disco viridibus, abdomine fulvo vitta fusca ornato, antennis nigris, pedibus flavis, tarsis anticis fulvis, alis subfulvis apud stigma fusco maculatis.*

Fem. Head yellow, brown behind around the insertion of the throat which is also yellow; crown bright green, with transverse furrows which differ in size: eyes bright red: mouth tawny: feelers black, very slightly increasing in thickness to the tips, full as long as the chest; first joint long, linear, tawny; second cup-shaped, tawny, brown above and at the base; third and fourth very short; the following joints from the fifth to the eleventh long, linear, successively decreasing in length; club long-conical, full twice the length of the eleventh joint: chest bright green, adorned here and there with copper-blue and purple-colour; breast and sides of the chest pale tawny: fore-chest rather large, subquadrate, completely sculptured with transverse irregular furrows, which are one of the characteristics of the *Torymidæ*; its length more than half its breadth: shield of the mid-chest very long, another peculiarity of this group; it is also deeply furrowed, but its fore-part appears almost smooth, the furrows being extremely small: sutures of the parapsides strongly marked, very slightly converging towards the hind-border of the shield, and there parted from each other by much more than half the breadth of the chest; axillæ separated by one-third of the breadth

of the chest; a rim on the hind-border of the shield; scutcheon nearly truncate-conical, convex behind, divided into two parts by a slight transverse ridge, which formation in the *Chalcidites* is a character of the development of that segment; the scutcheon is rugulose, coarsely so round the border, but the inequalities diminish in size towards the middle where the sculpture is minute and beautiful: the hind-chest is rather large, nearly obconical, declining; it is divided into three compartments by a transverse ridge which forms in the middle an angle joining the fore-border; the fore-compartments are short, and have each about six regular longitudinal ridges; the hind-compartment is longer and its ridges are more irregular, and it is subdivided by two slight furrows, and in the space between them there are two or three little transverse ridges: petiole extremely short: abdomen convex, spindle-shaped, smooth, shining, tawny, a little shorter and broader than the chest; sides yellow; metapodeon truncate-conical, concave towards the fore-border where it has three brown spots; the middle spot is heart-shaped, the side spots are triangular: along the back of the abdomen there is a brown stripe irregular in outline, and divided by the variations of its breadth into three parts; the first is cup-shaped, the second is nearly round, the third is spindle-shaped; the octoon is broad on each side, narrow in the middle of the back where a fissure divides it into two parts; it is free, or is not anchylosed with the following segment, which arrangement, a character of the *Torymidæ*, enables the abdomen to enjoy more freedom of motion for its functions, and to direct the movements of the ovipositor; ennaton, decaton and protelum large and of nearly equal size; paratelum and telum very short: sheaths of the ovipositor black, pubescent, as long as the body: legs yellow; hind hips tawny, brown at the base, much longer than the rest; thighs furnished with rows of white hairs; knees tawny; shanks pubescent; fore-shanks a little darker than the rest; fore-feet tawny; the peculiar dark colour of the fore-feet is very general among the *Chalcidites*; tips of the feet brown: wings with a very slight tawny tinge; veins dark brown, tawny towards the base of the wing; humerus beset with bristles towards its base, joining the fore-border by a very gentle curve; before this communication it sends forth a short slender curved tawny vein that descends into the disc of the wing; it is darker towards its tip, where it is traversed by a tawny stripe whose course is marked by a line of hairs; the ulna is about one-third of the length of the humerus; the radius is more than twice the length of the ulna; the cubitus is not more than one-fourth of the length of the ulna; the brand is large, oblong, emitting a short branch inclosed in a brown spot which is continued along the sides of the cubitus: the vein of the hind-wing after sinking below the fore-border during part of its course again joins it at its tip where it is furnished with the little hooks by which the fore-wings are attached to the hind-wings: the wings are pubescent, except at the base, where there are hardly any hairs. This species is distinguished from *M. dorsalis* by its larger size, its longer ulna and shorter radius, and by some slight differences in sculpture and colour.

South of Europe.

Eupelmus Tubatius, fem. *Viridis, metathoracis lateribus nitentibus, abdomine purpureo, oviductu brevi, vaginis fulvis, pedibus cupreis, tarsis flavis, alis fuscis, basi medioque limpidis.*

Head wanting: chest elliptical, green, slightly hairy, in structure like that of *E. urozonus*: hind-chest bright green on each side: abdomen spindle-shaped, depressed, purple, hairy, very much longer than the chest: sheaths of the oviduct tawny, very short: legs copper-colour, rather stout; knees tawny; feet yellow, with brown tips; tip of each middle shank armed with a long black spine; middle feet dilated, brown beneath: wings rather narrow: fore-wings brown, colourless at the base, and having an almost colourless band across the middle; veins piceous; ulna much longer than the humerus; radius shorter than the ulna; cubitus rather long, curved; wing-brand very small. Length of the body 3 lines; of the wings 5 lines.

a. Hong-Kong, China. In the British Museum.

Eulophus Harcalo, mas. *Nigro-æneus, antennis nigris, tarsis flavis, alis nigro-fuscis.*

Male. Small, æneous-black: feelers black, moniliform, and more than half the length of the body; first joint æneous-black, fusiform, long and slender; second cyathiform; third, fourth and fifth short-cyathiform, rather dilated, each emitting a short clavate branch at the base; seventh, eighth and ninth joints shorter and narrower than the preceding: chest elliptic, rather short and broad: abdomen linear and depressed, rather narrower but not longer than the chest: legs æneous-black; feet yellow with black tips; fore-feet darker: wings dark brown, rather short, somewhat paler at the base and at the tips; veins piceous; ulna rather longer than the humerus; radius much shorter than the ulna; cubitus much shorter than the radius, declining rather abruptly into the disc of the wing; stigma brand small. Length of the body $\frac{1}{2}$ line; of the wings $\frac{3}{4}$ line.

September; Bleasdale, near Lancaster.

Leucospis leucotelus, fem. *Nigra, capite antico antennisque ferrugineis, prothoracis marginibus scutellique margine postico flavis, alis nigricantibus apice albis.*

Body black, rather narrow, coarsely punctured, thinly clothed with short whitish hairs which are most prevalent on the face: face and mouth ferruginous; palpi brown: feelers dark ferruginous; sutures of the joints brown; first joint tawny beneath: fore-border and hind-border of the fore-chest and hind-border of the scutcheon yellow: abdomen compressed; sheaths of the oviduct ferruginous, extending to the fore-border of the scutcheon: legs pitchy; hind-thighs coarsely punctured, armed beneath with one long and with seven or eight small teeth; spines of the hind-shanks tawny: wings blackish; gray along the hind-borders; tips of the fore-wings white; veins black. Length of the body 5 lines; of the wings 10 lines.

Para. In the British Museum.

Chalcis fervida, fem. *Fulva, nigro fasciata et vittata, antennis nigris, pedibus fulvis, alis subfulvis.*

Body tawny, roughly punctured: feelers black, ferruginous at the tips; first joint tawny beneath: fore-chest short, narrower in front, concave along the hind-border, with a brown spot on each side: shield adorned on each side with two oblique black stripes which widen and unite towards the hind-border; the inner pair after a short interruption also converge and unite in front: a short black band on the scutcheon: propodeon large, obconical, reticulated with ridges; the compartments quadrilateral; a slight ridge along the middle, and a short black band at the base: petiole very short: abdomen smooth, shining, tapering from the base to the tip or clavate, narrower and much longer than the chest, compressed and hairy towards the tip; metapodeon large, conical, with a black band near the tip; octoon not half the length of the metapodeon; ennaton a little shorter than the octoon; decaton as long as the ennaton, traversed by a black band; protelum a little longer than the decaton, also traversed by a black band; paratelum much longer than the protelum; telum with a black tip, rather more than twice the length of the paratelum: legs tawny; hind-thighs armed beneath with one long sharp tawny and six small black blunt teeth; the fifth and sixth teeth double: wings slightly tawny; veins brown; humerus much less than half the length of the fore-border; ulna nearly half the length of the humerus; radius a little longer than the ulna; cubitus not one-fourth the length of the ulna, sending forth a very short branch; spurious vein tawny, indistinct. Length of the body $5\frac{1}{2}$ lines; of the wings 8 lines.

Para. In the British Museum.

Decatoma Neesii, Foërster. *Fulva, thoracis apice nigro, abdominis disco fusco, antennis pedibusque fulvis, alis anticis fusco semifasciatis.*

Fem. Body tawny: head and thorax punctured, slightly squameous: head transverse, a little broader than the thorax: eyes and ocelli piceous: feelers clavate, tawny, brown towards the base: base of the propodeon black: a broad irregular brown stripe along the back of the abdomen: legs tawny: wings colourless; veins tawny; ulna and radius very short; a pitchy spot beneath the ulna diffused into a broader brown band which descends into the disc of the wing. Nearly allied to *D. flavicollis.* Length of the body $\frac{2}{3}$ line; of the wings 1 line.

Inhabits Germany.

Palmon Sinensis, mas et fem. *Viridi-cyaneus, abdomine subtus fulvo, vaginis corpore fere duplo longioribus, antennis nigris, pedibus viridibus, tibiis anterioribus tarsisque anticis fulvis, tarsis posterioribus flavis, alis limpidis.*

Head and chest finely shagreened: head green, as broad as the chest: eyes red: mouth dark tawny: feelers black, club-shaped, much shorter than the chest: chest long and narrow, blue with a

green tinge: petiole short: abdomen compressed, smooth, shining, blue, brassy with a tawny tinge beneath, a little shorter than the chest: oviduct yellow, its sheaths black, nearly twice the length of the body: legs green; trochanters, four front shanks and fore-feet tawny; hind-hips and hind-thighs very large; the latter elliptical, armed beneath with six stout teeth; hind-shanks much curved, pitchy, tawny at the base, applied to the thighs; four hind-feet pale yellow with tawny tips: wings colourless; veins pitchy; ulna much shorter than the humerus; radius not more than one-sixth of the length of the ulna; cubitus very short, hardly half the length of the radius; brand very small. Length of the body $1\frac{2}{3}$ line; of the wings 3 lines.

Hong-Kong, China. In the British Museum.

Monodontomerus Anthophoræ, Newport, mas et fem. *Viridis, capite antico cyaneo, vertice maculis duabus cupreis ornato, abdominis fascia purpureo-cuprea, antennis nigris, pedibus viridibus, tarsis fulvis, tarsis anticis tibiisque ferrugineis, alis subcinereis.*

Male. Head and chest convex, finely shagreened: head green, full as broad as the chest, blue and nearly smooth in front, and having a large bright copper spot on each side of the crown between the eyes: eyes and eyelets red: feelers black, stout, compact, nearly filiform, much shorter than the chest; first joint long, slender, green; second cup-shaped; third and fourth extremely minute; the following joints from the fifth to the tenth successively but slightly decreasing in length; club conical, nearly thrice the length of the tenth joint: chest green, nearly spindle-shaped: fore-chest rather large, angular, but slightly narrower and rounded in front; its length a little more than half its breadth: shield of the mid-chest rather long; sutures of the parapsides strongly marked; axillæ coppery, parted by about one-fourth of the breadth of the chest: scutcheon conical, rather long, purplish coppery towards the tip; hind-scutcheon rather large: hind-chest transverse, short, declining: petiole very short: abdomen convex, slightly compressed, nearly spindle-shaped, shorter and rather narrower than the chest, purplish bronze, clothed with a few white hairs especially towards the tip; metapodeon bright green, coppery along the hind-border, about one-fifth of the length of the abdomen; octoon purplish bronze, not half the length of the metapodeon; ennaton longer than the octoon; decaton a little longer than the ennaton; protelum almost as long as the ennaton; paratelum shorter; telum very short: legs green; trochanters pitchy; knees tawny; shanks dark ferruginous with tawny tips; feet tawny; fore-feet and tips of four hinder feet ferruginous: wings slightly grey, pubescent, rather short; veins pitchy; ulna hardly half the length of the humerus; radius much less than half the length of the ulna; cubitus very short, about half the length of the radius; brand small, forked. Length of the body 2 lines; of the wings 3 lines.

England.

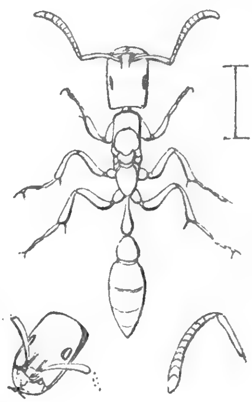
VI.—*Descriptions of some Hymenopterous Insects captured in India, with notes on their Œconomy, by* Ezra T. Downes, Esq., *who presented them to the Honourable the East India Company.* By Frederick Smith, Assistant Zoological Department, British Museum.

Genus Tetraponera.

Head elongate, sides parallel, the vertex slightly emarginate; eyes ovate, lateral, stemmata three, situated on the vertex; the antennæ 12-jointed, geniculate, subclavate, inserted in the sides of a raised prominence above the base of the clypeus; the mandibles stout, dentate, subarcuate, very broad at their apex, apical teeth crossing, slightly narrowed at their base. Thorax elongate, obtusely rounded at base and apex; legs moderate in length. Abdomen elongate, the two basal segments constricted, forming two nodes, the first half the width of the second; petiole elongate ovate, the second segment globose, the remaining portion of the abdomen elongate ovate.

Tetraponera atrata.

Female (length $4\frac{1}{2}$ lines) black, shining, the antennæ dark fusco-ferruginous, the basal joint one-third of their entire length; the mandibles rugose, pubescent, their apical tooth long and acute; the prothorax transverse in front, the anterior coxæ dilated, compressed at their sides, the claws rufo-testaceous, the calcaria testaceous. The abdomen has here and there a long hair or bristle, particularly on the first node of the abdomen and at the apex, the margins of the fourth and fifth segments narrowly piceous at their apical margins.



Hab. Bombay.

This insect as far as I know is unique, nor will it fall into any established genus; in some characters it approaches *Myrmecia*, the abdomen closely resembling that of the insects of that genus, but the head and thorax are totally different, there being no constriction between the meso- and meta-thorax; it also approaches the *Condylodon* of Lund in having short stout toothed mandibles, but it has small lateral eyes similar to *Ponera*. I should therefore assign it a place between *Ponera* and *Condylodon*.

I am only acquainted with one other species belonging to this genus; it is from South America, and is in the National Collection at the British Museum. I subjoin a description of the insect in a note *.

Genus HEDYCHRUM.

Hedychrum rugosa, n. s.

Length 3 lines. Head and thorax golden green, rugose-punctate; the eyes, antennæ and tegulæ black, the scape of the antennæ tinged with green; the tarsi rufo-piceous, the punctures on the scutellum and metathorax very large. The abdomen is green with a blue reflection, much more finely punctured than the thorax, except the sides of the basal segment which are rugose.

Hab. Poona.

Genus CHRYSIS.

Chrysis pubescens, n. s.

Length 3½ lines. Head and thorax brassy-green, rugose-punctate; the eyes and antennæ black, except the basal joint, which is brassy-green; the anterior margin of the prothorax deeply incurved, receiving the vertex of the head, the metathorax produced laterally into obtuse spines; the tegulæ and legs brassy-green, the tarsi rufo-testaceous; the wings dark fuscous, somewhat paler at their apical margins. Abdomen green, with a blue reflection, the apical segment chalybeous, quadridentate; the whole abdomen deeply punctured, and having, as well as the head and thorax, a short thin pubescence.

Hab. Bombay.

This species is parasitic on *Pelopæus*; the following are Capt. Downes's remarks: "A nest of *Pelopæus* was taken on the wall of my room; several of the cells were broken down whilst removing them, and various sorts of spiders fell out; one of the cells was a little denuded of its mud, so that I could see inside; this hole was repaired next day by a thin substance like talc, and

* *Tetraponera testacea.*

Female (length 3½ lines) testaceous, smooth and shining; the head elongate, truncate in front and behind, slightly emarginate at the vertex, a shallow impressed line running from the anterior stemma to the base of the antennæ, where it terminates in a deep sulcation carinate on its sides; the eyes black, the mandibles ferruginous, roughly channelled longitudinally with irregular striations, the teeth black; the mesothorax is darker than the rest of the thorax, and has a longitudinal scratch on each side; the metathorax is rounded posteriorly, very smooth and shining; the abdomen has a few scattered long hairs at its apex, and also on both its nodes; the third segment is also slightly constricted.

Hab. Napo, S. America.

In the collection of the British Museum.

if the cell reaches you safely, you will see what I mean; although the substance has been broken a little, it *was* quite perfect, and had the appearance of a little window. In another exposed cell was a *Chrysis*: by some means those enemies to everything, the red ant, found it out, and soon exposed the pupa; however, it was in a sufficiently forward state to show what it would have been. The *Pelopæus* made its appearance on the 4th of July; the nest just finished was taken on the 11th June 1848."

The "thin substance like talc" was the pupa-case spun by the *Pelopæus*; it still lines the mud cell, is transparent, and of brown colour.

Genus Scolia.

Scolia fervida, n. s.

Female (length 8 to 9 lines) black, the face coarsely punctured; eyes ovate, notched within, between the eyes in a fossulet a single ocellus and a curved impressed line above it; the margin of the vertex is punctured, but between this and the curved impression it is smooth and shining. Thorax deeply punctured, having two parallel smooth oblong spaces on the mesothorax smooth and shining; the wings dark fuscous, having a purple reflection, and having two submarginal and one recurrent nervure; the legs short, stout, and densely clothed with coarse black pubescence. Abdomen, the second segment has two lateral red maculæ varying in size, sometimes united; the second and third red, as also in some instances the base of the fourth.

Hab. Poona.

This species is one that presents variable characters as follows: one or two red spots in front of the ocellus, a red spot at the vertex of the eyes, also on each side of the collar, a lateral dark stain on the spots and segments of the abdomen; all these are more or less present in different individuals: in general appearance it approaches the *Scolia 4-pustulata* of Fabricius, but differs so much in the sculpture of the head and thorax as to remove all doubt of its being distinct.

Genus Ammophila.

Ammophila atripes, n. s.

Female (length 10 lines) black, the face adorned with silvery pile; the scape of the antennæ ferruginous in front; the prothorax and mesothorax transversely irregularly striate; the metathorax rugose; the tubercles covered with silvery pile, the tegulæ rufo-piceous, the wings fusco-hyaline, darkest at their tips; the femora, tibiæ, and basal joint of the tarsi red, the apical joints black; claws red, metathorax transversely striate. Abdomen,

the basal joint red, the second joint dark fusco-ferruginous, the rest of the segments of a violet blue.

Hab. Khandala; 1800 feet above the level of the sea.

Genus Pelopæus.

Pelopæus bilineatus, n. s.

Female (length $8\frac{1}{2}$ lines) black, the scape of the antennæ yellow in front; the prothorax has two yellow transverse spots nearly touching; the tegulæ, a perpendicular line beneath them, the post-scutellum, and two parallel oblong stripes on the metathorax, yellow; the apical half of the anterior femora and the tibiæ, the apical half of the intermediate femora, the tibiæ, the apical half of the basal joint of the tarsi, the trochanters, base of the femora and tibiæ, and basal joint of the tarsi of the posterior legs, yellow. Abdomen, the petiole yellow, the other segments beautifully aciculate.

Hab. Bombay.

I cannot find any description answering to the present species, and although some other species have the surface of the abdomen aciculate, still it is more beautiful and conspicuously so in this than in any species which I have seen. It was upon this insect that the *Chrysis pubescens*, described above, was parasitic. This fact, if any were wanting, since I have already published an account of *Chrysis* being reared from the nests of *Odynerus* and also of *Osmia*, proves that the parasite feeds on the larva, and not on the food stored up. *Pelopæus* provisions its nest with spiders; *Odynerus*, with lepidopterous larvæ; and *Osmia*, with the pollen of flowers.

Pelopæus separatus.

This insect only differs from the preceding in wanting the yellow spots on the collar and the two oblong stripes on the metathorax; the abdomen is sculptured precisely as in *P. bilineatus*, and the present insect is very probably only a variety.

Hab. Bombay.

In a letter, Col. Downes states that the nests of this species were constructed in his apartment, and he discovered one day that they were partly destroyed by *red ants*. In a partly demolished cell he observed an insect nearly matured; this proved to be the *Hedychrum rugosa* described above; thus we learn that species of *Hedychrum* and also of its ally *Chrysis* are parasites on the *Pelopæi*.

Genus Epipona.

Epipona marginata, St. Farg. Hist. Nat. Ins. i. 541. 3.

Of this species Col. Downes says, "I must call your attention

to one of the *Hymenoptera,* which you will find with its cells: I have confirmed what I never had an opportunity of doing before, although it has been stated by authors that the young are fed by the parent; such was the case in this instance, as I had daily opportunities of seeing the larva fed. A single egg is deposited in each cell very soon after the commencement of it, and the cell is built up as the larva grows, not finished at once; and the parent possesses the necessary instinct to close the cells when the larvæ are ready to undergo their change."

This is a very interesting note, and shows how closely these smaller communities of wasps resemble those of the more populous species of *Vespidæ.* The common wasp of Europe, the *V. vulgaris,* deposits her eggs in cells which are only raised about the eighth of an inch; and as the larva grows the cells are built up. But I do not feel at all satisfied that the working wasps close the cells as soon as the larvæ are full-fed. On dissolving the comb of a wasp's nest, it will be found that the covering is not merely over the mouth of the cell, but that it is continued down the sides within, varying in extent in different species. I cannot but think that the cells are closed by the larvæ themselves, not only in wasp communities, but also in those of the social *Apidæ.*

The nest of this species is similar to that of *Polistes,* being merely a comb of exposed cells twenty-five in number, from six of which the perfect insect has come forth, the other cells being of different heights; but all contain either an egg, a larva, or a pupa.

Epipona variegata.

Female (length $3\frac{1}{2}$ lines) ferruginous, a line within the eyes reaching the emargination, the clypeus and a spot above it between the antennæ, the scape in front, the mandibles and a broad line behind the eyes, yellow; the clypeus has a ferruginous stain in the centre. Thorax, the anterior margin of the metathorax, the collar, tegulæ, a spot beneath the wings, the anterior margin of scutellum, the post-scutellum, two ovate maculæ on the metathorax, two spots on the breast, the coxæ in front, and a line on the anterior and intermediate femora beneath, and also a line on all the tibia above, yellow. Abdomen, a minute spot at the apical margin of the peduncle, two ovate maculæ at the base of the second segment and a broad band at its apical margin, yellow; a fuscous spot occupies the apical half of the marginal cell.

Hab. Poona.

This species was accompanied by its nest, which consists of a single comb of cells about an inch in length and half an inch

broad; it has nineteen cells, nine of which are perfect: from five have emerged perfect insects, and four contain pupæ more or less advanced towards perfection: the comb is attached to a leaf by a slender footstalk.

Genus Ancistrocerus.

Ancistrocerus ornatus, n. s.

Male (length $4\frac{1}{2}$ lines) ferruginous, the clypeus and face as high as the top of the notch of the eyes, the scape of the antennæ in front, the mandibles and cheeks yellow; the stemmata are inclosed in a coronet-shaped black spot on the vertex; the margin of the prothorax, the tegulæ and posterior portion of the tubercles, the anterior and intermediate tibia and tarsi, also their coxæ in front, yellow; the lateral margins of the scutellum and post-scutellum and also the margin of the collar narrowly stained more or less with yellow; all the impressed divisions of the parts of the thorax are stained more or less black; a dark fuscous spot occupies the marginal cell, extending a little beyond; abdomen, the apical margins of the segments are more or less of a yellowish tinge, as is also the second segment beneath; the second and third segments above are black at their basal margins.

Hab. Bombay.

This is a very beautiful and apparently undescribed species; it is from Bombay.

Ancistrocerus guttatus.

Female (length $4\frac{1}{2}$ lines) black: the clypeus, base of the mandibles, the scape of the antennæ, a line running from the clypeus and filling the notch of the eyes, and an elongate-ovate macula behind the eyes near the vertex, bright yellow; a black line on the scape behind at its apex; the clypeus bidentate at its apex; a broad macula on each side of the prothorax touching in the centre, the tegulæ, a round spot beneath the wings, the scutellum and post-scutellum, a large ovate macula on each side of the metathorax, the intermediate and posterior coxæ, spotted with yellow; all the femora, tibiæ and tarsi yellow; the posterior femora are only yellow towards the apex beneath, and the tarsi are stained ferruginous; the costal and externo-medial cell have a slight fuscous cloud as well as the apical margins; a dark fuscous spot is inclosed in the marginal cell. Abdomen, the margins of all the segments and a large round macula on each side of the second segment yellow; beneath, a broad yellow fascia occupies the apical margin of the second segment and is bisinuate.

Hab. Khandala.

Genus Prosopis.

Prosopis mixtus.

Female (length $2\frac{1}{4}$ lines) black; the clypeus cream-coloured; the tubercles and tegulæ white; the wings white, hyaline; all the tarsi pale ferruginous; the pubescence on the posterior legs white; the margins of the abdominal segments testaceous; the disk of the thorax is very smooth and shining.

Hab. Ind.

Although I have placed this insect in the genus *Prosopis,* I do not feel quite satisfied that it belongs to it; in the neuration of the wings it exactly corresponds with that genus. I cannot examine the tongue, and the specimen described is much mutilated and gummed to a piece of card, and is altogether in bad condition. I have described it, believing it to be an *Hylæus,* as it is to me a new habitat for the genus.

BIBLIOGRAPHICAL NOTICES.

A Naturalist's Sojourn in Jamaica. By P. H. Gosse. 1851. 12mo. Longman and Co.

There are perhaps few parts of the world of whose natural productions we know less than those of our own West Indian Colonies. At first sight this may appear rather surprising, considering the number of Europeans constantly residing in those beautiful islands; but as most of these regard the old country as their home, and their sojourn in the West Indies only as a means of making money, they are still, as in the time of Bancroft, "more attentive to the acquisition of wealth than natural knowledge." Occasionally indeed some clergyman or medical man does pay a little attention to the natural objects which surround him; but the number of these exceptions is but small, whilst few of them ever do more for the preservation and publication of their observations than the insertion of a notice of some remarkable occurrence in one of the innumerable 'St. George's Chronicles' or 'Kingston Gazettes,' or an occasional article in one of those red-covered almanacs, which, to European eyes, have such a curiously exotic appearance.

The natural history of Jamaica has once or twice engaged the attention of naturalists and been made the subject of a special treatise, but much remained to be done,—how much, the present delightful volume, the result, or rather part of the result, of a "sojourn" of only nineteen months in the island, will abundantly show.

Mr. Gosse is too well known as an acute observer of nature, and his reputation as an agreeable writer is too well established, to leave much doubt in the minds of our readers that a book from his pen on the natural history of Jamaica, perhaps the most beautiful of tropical islands, will contain an abundance both of information and entertain-

ment, and we believe we cannot do better, either for our readers or Mr. Gosse, than by letting that gentleman speak for himself.

Speaking of Lizards (p. 74), he says—

"One feature with which a stranger cannot fail to be struck on his arrival in the island, and which is essentially tropical, is the abundance of the lizards that everywhere meet his eye. As soon as ever he sets foot on the beach, the rustlings among the dry leaves, and the dartings hither and thither among the spiny bushes that fringe the shore, arrest his attention*; and he sees on every hand the beautifully coloured and meek-faced Ground Lizard (*Ameiva dorsalis*) scratching like a bird among the sand, or peering at him from beneath the shadow of a great leaf, or creeping stealthily along with its chin and belly upon the earth, or shooting over the turf with such a rapidity that it seems to fly rather than run. By the roadsides and in the open pastures, and in the provision-grounds of the negroes, still he sees this elegant and agile lizard; and his prejudices against the reptile races must be inveterate indeed, if he can behold its gentle countenance, and timid but bright eyes, its chaste but beautiful hues, its graceful form and action, and its bird-like motions, with any other feeling than admiration.

"As he walks along the roads and lanes that divide the properties, he will perceive at every turn the smooth and trim little figures of the Wood-slaves (*Mabouya agilis*), basking on the loose stones of the dry walls; their glossy fish-like scales glistening in the sun with metallic brilliance. They lie as still as if asleep; but on the intruder's approach they are ready in a moment to dart into the crevices of the stones and disappear until the danger is past.

"If he looks into the outbuildings of the estates, the mill-house, or the boiling-house, or the cattle-sheds, a singular croaking sound above his head causes him to look up; and then he sees clinging to the rafters, or crawling sluggishly along with the back downward, three or four lizards, of form, colour, and action very diverse from those he has seen before. It is the Gecko, or Croaking Lizard (*Thecadactylus lævis*), a nocturnal animal in its chief activity, but always to be seen in these places, or in hollow trees, even by day. Its appearance is repulsive, I allow, but its reputation for venom is libellous and groundless.

"The stranger walks into the dwelling-house. Lizards, lizards, still meet his eye. The little Anoles (*A. iodurus, A. opalinus*, &c.) are chasing each other in and out between the jalousies, now stopping to protrude from the throat a broad disk of brilliant colour, crimson or orange, like the petal of a flower, then withdrawing it, and again displaying it in coquettish play. Then one leaps a yard or two through the air, and alights on the back of his playfellow; and both struggle and twist about in unimaginable contortions. Another is running up and down on the plastered wall, catching the ants as they roam in black lines over its whited surface; and another leaps from the top of some piece of furniture upon the back of the visitor's

* "Nunc virides etiam occultant *spineta* lacertos."—VIRG.

chair, and scampers nimbly along the collar of his coat. It jumps on the table;—can it be the same? An instant ago it was of the most beautiful golden green, except the base of the tail, which was of a soft, light, purple hue: now, as if changed by an enchanter's wand, it is of a sordid sooty brown all over, and becomes momentarily darker and darker, or mottled with dark and pale patches of a most unpleasing aspect. Presently, however, the mental emotion, whatever it was, anger, or fear, or dislike, has passed away, and the lovely green hue sparkles in the glancing sunlight as before.

"He lifts the window-sash; and instantly there run out on the sill two or three minute lizards of a new kind, allied to the Gecko, the common Pallette-tip (*Sphæriodactylus Argus*). It is scarcely more than 2 inches long, more nimble than fleet in its movements, and not very attractive.

"In the woods he would meet with other kinds. On the trunks of the trees he might frequently see the Venus (*Dactyloa Edwardsii*), as it is provincially called; a lizard much like the Anoles of the houses, of a rich grass-green colour, with orange throat-disk, but much larger and fiercer: or in the eastern parts of the island the great Iguana (*Cyclura lophoma*), with its dorsal crest like the teeth of a saw running all down its back, might be seen lying out on the branches of the trees, or playing bo-peep from a hole in the trunk: or in the swamps and morasses of Westmoreland the yellow Galliwasp (*Celestus occiduus*), so much dreaded and abhorred, yet without reason, might be observed sitting idly in the mouth of its burrow, or feeding on the wild fruits and marshy plants that constitute its food."

As might be expected from this extract, the natural history of the lizards forms a very important portion of Mr. Gosse's work, which accordingly contains many interesting observations on this somewhat despised class of animals, including a long and valuable communication from the author's friend, Mr. Hill, on the Alligator or native Crocodile. Let us turn now to a class more generally attractive, and see one of the most beautiful of the feathered inhabitants of the air in a state of nature:—

"While I was up in the calabash-tree," says Mr. Gosse (p. 48), "engaged in detaching the bunches of *Oncidium*, the beautiful Long-tailed Humming-bird (*Trochilus polytmus*) came shooting by, with its two long velvet-black feathers fluttering like streamers behind it, and began to suck at the blossoms of the tree in which I was. Quite regardless of my presence, consciously secure in its power of wing, the lovely little gem hovered around the trunk, and threaded the branches, now probing here, now there, its cloudy wings on each side vibrating with a noise like that of a spinning-wheel, and its emerald breast for a moment flashing brilliantly in the sun's ray; then apparently black, all the light being absorbed; then, as it slightly turned, becoming a dark olive; then in an instant blazing forth again with emerald effulgence. Several times it came close to me, as I sat motionless with delight, and holding my breath for fear of alarming it and driving it away; it seemed almost worth a voyage across the sea to

behold so radiant a creature in all the wildness of its native freedom."

With one more extract, also relating to birds, we must conclude our notice of this interesting book; it is headed—*Voices of early Birds*:—

"April 29th.—I rose some hours before the sun, and proceeded to the Peaks of Bluefields. Passing through the wooded pastures and grass-pieces of Pinnock-Shafton, I was interested in the voices of 'earliest birds.' While as yet no indication of day appeared over the dark mountain, no ruddy tinge streamed along the east; while Venus was blazing like a lamp, and shedding as much light as a young moon, as she climbed up the clear dark heaven among her fellow-stars;—the Piramidigs or Nightjars were unusually vociferous, and careering in great numbers; they flew low, as I could perceive by listening to their sounds, but were utterly undistinguishable to the sight from the darkness of the sky across which they flitted in their angular traverses. Presently the Flat-bill uttered his plaintive wail, occasionally relieved by a note rather less mournful. When the advancing light began to break over the black and frowning peaks, and Venus waned, the Peadove commenced from the neighbouring woods her fivefold coo, hollow and moaning. Then the Petchary cackled his three or four rapid notes; and from a distant wooded hill, as yet shrouded in darkness, proceeded the rich, mellow, but broken song of the Hopping Dick. Now the whole east was ruddy, and the rugged points and trees on the summit of the mountain-ridge, interrupting the flood of crimson light, produced the singularly beautiful phænomenon of a series of rose-coloured beams, diverging from the eastern quarter, and spreading like an expanded fan across the whole arch of heaven, each ray dilating as it advanced. Then mocking-birds all around broke into song, pouring forth their rich gushes and powerful bursts of melody, filling the ear, and overpowering all the other varied voices, which now helped to swell the morning concert of awakening birds."

In another passage, Mr. Gosse has well refuted the erroneous idea that the birds and flowers of the tropics are destitute of song and scent, and furnished us with a long list of marked exceptions to this so-called rule; whilst in many other places, in descriptions of the various scenes in which his researches were carried on, he has communicated a great deal of information on tropical vegetation which will be exceedingly interesting to the botanist. A considerable number of new species of animals are described in various places, some of them illustrated by coloured figures, and the work is also adorned with views of several of the scenes described: it is certainly a most interesting and valuable addition to our stock of information on tropical natural history.

In conclusion, however, we cannot but express our regret, that Mr. Gosse should have allowed himself to fall into the common cant of *soi-disant* field-naturalists in speaking against all branches of natural history except their own. We should have thought that one who in his own department can work so well, might have rested his claim to be regarded as a naturalist on the merits of his works, without re-

sorting to any illiberal depreciation of the equally valuable labours of others. And indeed, without the assistance of these despised *closet-naturalists*, what would the works of Mr. Gosse and other field-naturalists become?—a mere chaos! a mass of inextricable confusion! Mr. Gosse may rest assured, that other and far higher powers than those of the mere observer are required by those who endeavour to bring the disjointed materials furnished by field-naturalists and species-describers into something like order,—to make them subservient to the progress of science towards its true object, the development of our knowledge of the system of nature. "*This* is natural history."

Man and his Migrations. By R. G. Latham, M.D., F.R.S. &c. Van Voorst, 1851, fc. 8vo, pp. 250.

The Ethnology of the British Colonies and Dependencies. By R. G. Latham, Esq., M.D. &c. London: Van Voorst, 1851, fc. 8vo, pp. 264.

Few things testify more strongly to the contracted views and the want of philosophic insight, which result from the systems of education generally adopted in this country, than the excessive estimation of 'practical' science, as it is termed, in contradistinction to that form of inquiry which is content to go forward in the simple hope of discovering truth, with the purpose of bringing the laws regulating all cosmical phænomena into the domain of human knowledge. That short-sightedness which approves only of the pursuit of trains of investigation likely to result speedily in the acquisition of means of increasing material wealth, may be pardoned in the uneducated, whose sole conceptions of science are derived from the vague impressions made upon their minds by the astonishing applications of abstract theory now so abundantly met with in all civilized communities; but to those who have the opportunity of knowing the history of human progress in any one department, it cannot be pardoned that they should shut their eyes to the universal fact of 'practical' value being a quality which science can only exhibit in an advanced stage of its cultivation; and further, it may be assumed that they have but a very imperfect idea of the nature and object of human endowments, who do not recognize that that power of cultivating intellect necessarily involves a corresponding amount of duty.

The most satisfactory signs of a more liberal tone, of a more comprehensive spirit in the exercise of thought, are furnished by the growing interest among educated persons generally in those departments of knowledge which are conversant with the progressive changes of the earth and its inhabitants. And it would seem as though physical science, not content with its own wonderful development, had pressed over into the domain of moral science, disturbing history in its endless coiling inward upon itself, and was striving to wrest from it facts which were once its undisputed property, to build a new science of progress upon them. It is however the 'method' which leads us to this fancy; the real case is that a new science has grown up, in which physical science and history go hand in hand in

an endeavour to trace back the past phænomena of human existence, and to derive from this the laws which will regulate its future progress.

The natural history of the human race, or Ethnology, taking rank as it now does from its method among the inductive sciences, has grown up rapidly in recent years, and now claims a place, which must be assigned to it, at the head of those studies which deal with the external phænomena of the world we live in, in virtue of its subject, the last and highest product of creation. Those who would know how it has arrived at its present position will find a clear and brief history of the growth of this science in the first of the two books mentioned at the head of our notice. 'Man and his Migrations' forms a compendious introduction to ethnology, which will be hailed with exceeding satisfaction by neophytes; and by the terse, nervous exposition of principles, and the pregnant suggestions of paths to be opened and problems to be solved, is calculated to exercise no little influence upon students reading with knowledge. In the first three chapters are given the history, definition and method of the science, treated in an eminently philosophical and logical manner; the three succeeding chapters contain an outline of the distribution of the various races, so far as is at present known or reasonably supposed; so that in the brief compass of this little volume are traced all the principal features of the science; a sketch, it is true, but this marked with such decision as to convey to the thinking reader a clearer and more complete impression than could have been expressed in a more diffuse and finished style within the space of half a dozen such volumes.

There is one point to which we may perhaps advert here, though one of little importance practically speaking. This occurs in the definition of the science. Dr. Latham draws a distinct line between a so-called science of anthropology and ethnology proper, illustrating the difference between them by several striking examples; but it seems to us that the anthropology, which is confined, as Dr. Latham would confine it, to the study of the natural history of man as compared with the lower animals (while ethnology treats of the characteristics of his varieties) is in fact a part of zoology, and not scientifically to be separated from it. We can only understand anthropology as a substantive science when it is built upon both psychology and physiology. In a word, we demur to the separation of anthropology and ethnology, as given by Dr. Latham, since the natural history of the varieties of a species (ethnology) is strictly speaking only the complete natural history of the species (anthropology).

Leaving this question of words, we have only space to say, that the second work is a development of the subject-matter of the latter chapters of 'Man and his Migrations,' into the details of the distribution of the races peopling Britain and its wide dependencies. In this very interesting dissertation, fuller particulars are given respecting the races treated of, than was possible in the limited compass of the former work; the interest attaching to these details will be more felt by the professed ethnologist than by the general reader, from the

necessarily fragmentary and unsettled state of many most important branches of the subject.

One thing is quite certain—no one will rise from reading either of these works with the idea of knowing more than he actually does; on the contrary, close attention is necessary to follow the close reasoning of the author. But if, as few will doubt, the chief value of scientific study, to any but professed inquirers, is the discipline it exercises upon the mind, such a characterization is praise; while, it may be added, the professed student who is repulsed by too severe a logic in his teacher, must not expect to go far.

Revue des Odonates ou Libellules d'Europe. Par EDM. DE SELYS-LONGCHAMPS, Membre de plusieurs Sociétés savantes. Avec la collaboration de M. le Docteur HAGEN. Bruxelles et Leipzig, chez C. Murquardt: à Paris, chez Roret. 8vo. Mars 1850.

In our 7th vol. p. 141, we gave a review of the 'Monographie des Libellulides d'Europe' by the same author in 1840, and this may be considered as a second edition of that work, with additions and improvements, such as might be expected from the known zeal and indefatigable industry he has manifested in this greatly neglected but very beautiful family—the difficulties attending on these being much greater than many of the other groups, from the strong power of wing eluding often the grasp of our most active collectors, as well as the fragile nature of their legs and the evanescent quality of the colours when taken (unless carefully prepared).

The work consists of 408 pages and 11 lithographic plates illustrative of the genera and species: viz. (* *before* are British.)

Libellula trinacria, *De Selys.*
*4-maculata, *L.*
*depressa, *L.*
*fulva, *Müll.* (conspurcata, *Chp.*)
*cancellata, *L.*
albistyla, *De Selys.*
nitidinervis, *De Selys.*
sardosa, *Ramb.*
cycnos, *De Selys.*
brunnea, *Fonsc.*
Ramburii, *De Selys.*
*cærulescens, *Fab.*
erythræa, *Brulle.*
rubrinervis, *De Selys.*
pedemontana, *Allioni.*
depressiuscula, *De Selys.*
*sanguinea, *Müll.* (Rœselii, *Curt.*)
*flaveola, *L.*
?*Fonscolombii, *De Selys.*
*meridionalis, *De Selys.*
*striolata, *Chp.*
*Libellula vulgata, *L.* (near Hull.)
*Scotica, *Donov.*
*dubia, *Vand. Lind.* (Yorks.), *Brit. Ent.* pl. 712 as next. [The Epping specimen is either a large one of *dubia* or small one of next. De Selys could not quite determine, but he thought the latter.]
?*rubicunda, *L.* (Epping.)
pectoralis, *Chp.*
albifrons, *Burm.*
caudalis, *Chp.*
nigra, *Vand. Lind.*
Epitheca bimaculata, *Chp.*
Cordulia metallica, *Vand. Lind.*
alpestris, *De Selys.*
*arctica, *Zetterst.* (Scotland and Ireland.)
flavomaculata, *Vand. Lind.*
*ænea, *L.*
*Curtisii, *Dale, B. E.* pl. 616.

Macromia splendens, *Pictet.*
Gomphus *vulgatissimus, *L.*
*flavipes, *Chp.* (Dover?, Hastings? or Sandgate?) [Three localities have been given for *one* specimen, having been mistaken for the former.]
Graslini, *Ramb.*
simillimus, *De Selys.*
pulchellus, *De Selys.*
serpentinus, *Chp.*
uncatus, *Chp.*
?*forcipatus, *L.*
Genei, *De Selys.*
Lindenia tetraphylla, *Vand. Lind.*
Cordulegaster *annulatus, *Latr.*
bidentatus, *De Selys.*
Anax *formosus, *Vand. Lind.*
parthenope, *De Selys.*
Æschna *pratensis, *Müll.* (teretiuscula, *Leach.*)
*cyanea, *Latr.* (varia, *Haw.*)
*juncea, *L.*
*mixta, *Latr.* (anglicana, *Leach.*)
*borealis, *Zett.* (Scotland, two examples.)
affinis, *Vand. Lind.*
alpina, *De Selys.*
viridis, *Eversm.*
*rufescens, *Vand. Lind.*
*grandis, *Linn.*
Irene, *Fonsc.*
Callopteryx *virgo, *L.*
*splendens, *Harris.*
Callopteryx hæmorrhoidalis, *Vand. Lind.*
Epallage Fatime, *Chp.*
Lestes ?*viridis, *Vand. Lind.*
macrostigma, *Eversm.*
*nympha, *De Selys.*
*sponsa, *Hans.*
*virens, *Chp.* (New Forest?)
?*barbara, *Fab.* (Ireland ?)
fusca, *Vand. Lind.*
Platycnemis acutipennis, *De Selys.*
latipes, *Ramb.*
syriaca, *Hagen.*
*pennipes, *Pallas.*
Agrion speciosum, *Chp.*
viridulum, *Chp.*
*najas, *Hans.* (Whittlesea, &c., and Ireland.)
*minium, *Harris.*
*tenellum, *Vill.* (Dorset, &c.)
*pumilio, *Chp.* (New Forest, &c., ♀ var. *B. E.* pl. 732.)
Graeslii, *Ramb.*
Genei, *Pictet.*
*elegans, *Vand. Lind.*
armatum, *Heyn.*
elegantulum, *Zetterst.*
*pulchellum, *Vand. Lind.*
*puella (*L.*), *Vand. Lind.*
ornatum, *Heyn.*
*cyathigerum, *Chp.*
hastulatum, *Chp.*
lunulatum, *Chp.*
scitulum, *Ramb.*
cærulescens, *Fonsc.*
*mercuriale, *Chp.* (Dorset.)
Lindenii, *De Selys.*

A few follow which have been found in Asia Minor and Algiers which probably *visit* Europe?, and those found in a fossil state, some of which appear to be *quite* of an extra-European form. Thus the total number of ascertained European Libellulæ are 98 species, of which we have 46 British only, 3 or 4 of which are doubtful.

The geographical distribution of them is given for the different countries of Europe. But the numbers from the other quarters of the globe may be expected to be far more numerous, if we can form an opinion from the examples received from the river Amazon collected there by Messrs. Bates and Wallace; and we have reasons for knowing that the Baron de Selys is now preparing materials for a much larger work on the Order NEUROPTERA, but which will necessarily take a long time to accomplish, from the extreme difficulty in visiting the various collections of Europe to ascertain *all* the species, several of which are unique. We will only further recommend these works to all who wish to study this order as indispensable.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

July 9, 1851.—John Gould, Esq., F.R.S., in the Chair.

DESCRIPTION OF A NEW GENUS OF THE FAMILY MELANIANA, AND OF MANY NEW SPECIES OF THE GENUS MELANIA, CHIEFLY COLLECTED BY HUGH CUMING, ESQ. BY ISAAC LEA AND HENRY C. LEA, PHILADELPHIA *.

Genus PACHYCHILUS †.

Testa conica. Apertura ovata, basi integro. Labrum crassum. Columella supernè incrassata. Operculum suborbiculare, corneum.

The genus *Melania* has been found to embrace such a vast number of species in various parts of the globe, that it has become very desirable to separate any definite group with sufficient persistent characteristics. The thickened lip sufficiently distinguishes the proposed genus from *Melanopsis* and *Melania* ‡. It differs from *Melanopsis* also in its having no sinus, while it resembles it in the possession of a thickened columella above. From *Melania* it differs also in having this callous columella. The species on which it is proposed to found this genus has a mouth looking like a thick-lipped *Bulimus*. The operculum differs somewhat from that of any *Melanian* I have seen. Its polar point is subcentral, from which two or three spiral revolutions are made ; then a thinner margin surrounds these spirals.

The animal has not been observed, and may and probably will prove very different from *Melania*. Its proper position, however, in the system will most likely be found to be between *Melanopsis* and *Melania*, and there I would at present place it.

A second and very distinct species may be added to this genus—the *Melania lævissima*, Sowerby, described in Deshayes' edition of Lamarck. It inhabits Colombia, and is a shorter, wider, and much thicker shell, with a large white mouth.

PACHYCHILUS CUMINGII. *P. testâ lævi, elevato-conicâ, subcrassâ, nitidâ, fusco-nebulosâ ; spirâ elevatâ, acuminatâ ; anfractibus undecim, convexiusculis ; suturis linearibus ; aperturâ parviusculâ, subrotundâ, ad basim rotundâ, intus fuscâ ; labro valdè expanso ; columellâ supernè incrassatâ.*

Hab. Large rivers, Copan, Central America.

Length 1·4, diam. ·5 of an inch.

Remarks.—This is a very remarkable shell among the *Mélaniens*. It is of fine symmetry, the whorls being very regular to the apex. The brownish cloudiness gives the whole surface a dark hue, while the smoothness of the whorls gives it almost a polished appearance. It differs very much in form from *Melania lævissima*, Sow., which naturally belongs to the same genus, and which is adopted above ;

* All the species described are in the Cabinets of Hugh Cuming and Isaac Lea.

† Παχὺς, *thick*, and χεῖλος, *lip*.

‡ Lamarck describes the family *Mélaniens* as having a sharp outer lip, "le droit toujours tranchant ;" but this genus naturally belongs to *Melania*, *Melanopsis*, and *Pirena*.

but it has the same character of mouth and exterior colour. Both species under the microscope exhibit very minute revolving striæ. The aperture is rather more than one-fourth the length of the shell. The operculum has its polar point subcentral.

The genus *Melania* of Lamarck abounds in a most extensive number of species, and is undoubtedly the most interesting of the genera of the family *Melaniana*. It is distributed round the whole circumference of the globe, and inhabits the fresh waters of America at least as far north as 45° latitude, and it probably exists quite as far south, as it is found in New Zealand. In the north of Europe there is not a single species known, while very few are found in the southern part of that quarter of the world. In the middle, southern and south-western portions of the United States, the greatest number of species seem to be developed on this continent; and in the States of Kentucky, Ohio, Tennessee and Alabama they are the most profuse, and present an almost endless variety of forms, extending to an incredible number of species. The rivers and lakes of India and Africa have not yet been well explored; but while they present some of the most striking and beautiful species, it may be doubted if they abound in the variety of forms which are found in the United States. The Philippine Islands form a most prolific district, where the development of these forms seems to have been greatly extended. Mr. Cuming, with an industry, energy and perseverance which portray the true naturalist, devoted several years to the Mollusca of this remarkable group of islands, and his reward has been, the discovery of a vast number of species heretofore unknown to science; and he well deserves the gratitude of all students of this branch of natural history for his devotion to the collection of a museum, almost, if not quite, unequalled in the Mollusca.

Melania canalis. *M. testâ lævi, acuto-conoideâ, subtenui, tenebroso-castaneâ, flammis longitudinalibus ferrugineis ornatâ; spirâ elevatâ, ad apicem costatâ; suturis impressis canaliculatisque; anfractibus duodecim, subconvexis; aperturâ ovatâ, ad basim patulâ, intus albidâ.*

Hab. Small streams, island of Guimaras, Philippines.

Length 2·1, diam. ·6 of an inch.

Remarks.—This is rather a large and somewhat robust species. The full-grown specimens are of a dark chestnut-brown, the younger sometimes a pale horn-colour, with longitudinal flammate marks, nearly equidistant, and with distinct minute transverse striæ. The most remarkable character of this species is the impressed and rather sharp channel at the junction of the whorls. The aperture is nearly one-third the length of the shell, and the base is expanded, the columella below being flattened.

Melania fœda. *M. testâ lævi, conoideâ, subcrassâ, tenebroso-fuscâ, rufo-nebulosâ; spirâ subelevatâ; suturis subimpressis; anfractibus decem, planulatis; aperturâ ellipticâ, subcontractâ, ad basim subangulatâ, intus tenebroso-castaneâ; labro margine cærulescente.*

Hab. Rocky stream, Java.

Length 1·6, diam. ·5 of an inch.

Remarks.—In the adult specimens the edge of the aperture is bluish white, and within more or less brown. In all cases the columella is white in the four specimens under examination. They are covered nearly over the whole surface with a black deposit of oxide of iron. Near the base there are seven to ten indistinct striæ. The aperture is about one-third the length of the shell. The operculum is ovate, and does not present any peculiar character.

Melania sobria. *M. testâ lævi, acuto-conoideâ, subcrassâ, luteo-corneâ; spirâ elevatâ, ad apicem costatâ; suturis impressis; anfractibus duodecim, planulatis; aperturâ parvâ, subovatâ, intus albidâ, ad basim rotundatâ; columellâ regulariter curvatâ.*

Hab. Very small streams, Siquijor, Philippines.

Length 1·5, diam. ·5 of an inch.

Remarks.—A very regularly formed, light-coloured species. There are a few indistinct striæ near the base. The sutures are very regular and thread-like. The upper whorls are slightly maculate, and those nearest to the apex minutely plicate. The aperture is rather more than the fourth of the length of the shell, and is rounded at the base of the columella.

Melania subula. *M. testâ lævi, acuto-conoideâ, tenui, castaneâ; spirâ valdè elevatâ, acuminatâ; suturis impressis; anfractibus duodecim, subconvexis; aperturâ parvâ, contractâ, intus vel albidâ vel rufo-castaneâ.*

Hab. Small river in the province of Ho Ho, isle of Panay, Philippines.

Length 1·8, diam. ·4 of an inch.

Remarks.—This is a delicately formed species, very much attenuated, with six or eight impressed, small striæ at the base. In the darker specimens, the upper part of the whorl at the suture is lighter-coloured than the other part. The upper whorls are finely striate. The aperture is small, about one-fourth the length of the shell, and rounded at the base of the columella.

Melania acus. *M. testâ lævi, conoideâ, subtenui, corneâ; spirâ acuminatâ, ad apicem costatâ; suturis subimpressis; anfractibus undecim planulatis; aperturâ parvâ, ovatâ, intus cærulescente; columellâ regulariter curvatâ.*

Hab. Small stream, Guimaras, Philippines.

Length 1·1, diam. ·3 of an inch.

Remarks.—This is a regularly formed, small species. The specimens under examination are nearly covered with a deposit of oxide of iron, which on removal displays a horn-coloured epidermis. The aperture is nearly one-third the length of the shell, and is rounded at the base.

Melania dermestoidea. *M. testâ lævi, politâ, subcylindraceâ, crassâ, tenebroso-castaneâ; spirâ subelevatâ; suturis impressis; anfractibus sex, subplanulatis; aperturâ ovatâ, ad basim canaliculatâ, intus rufescente; labro incrassato.*

Hab. Seychelles Islands.

Length ·6, diam. ·2 of an inch.

Remarks.—The most marked character of this species is the notched channel of the base, where the colour is rather darker. The outer lip is thick and rounded. The superior part of the whorl in some specimens is lighter in colour. In its general aspect this species resembles *Melania simplex*, Say. The epidermis is very lustrous. The aperture is nearly one-half the length of the shell.

Melania contracta. *M. testâ lævi, ovato-elongatâ, pallidâ, tenui; spirâ elevatâ; anfractibus novem, planulatis; aperturâ ovatâ, constrictâ, ad basim canaliculatâ, intus vel albidâ vel rufâ; columellâ contortâ reflexâque.*

Hab. Seychelles Islands.

Length ·8, diam. ·3 of an inch.

Remarks.—This, like the *dermestoidea*, herein described, from the same locality, is remarkable for the notched channel at the base. They may easily be distinguished by the *contracta* having a more elevated spire, greater number of whorls, being of a lighter colour, and in the aperture being longer and more twisted. There is a disposition in the upper part of the columella to be thickened and rufous, and the twist and backward turn are very remarkable. The aperture is about one-third the length of the shell.

Melania ferruginea. *M. testâ lævi, nitidâ, ventricoso-conoideâ, inflatâ, crassâ, ferrugineâ; spirâ subelevatâ; suturis valdè impressis; anfractibus sex, convexis; aperturâ magnâ, subrotundâ, intus albidâ.*

Hab. Zanzibar, East Africa.

Length ·9, diam. ·4 of an inch.

Remarks.—The rather inflated form of this species gives it the aspect of some of the *Paludinæ*. A single specimen, and not an entirely perfect one, has only been submitted for examination. It seems to differ from any described species, while it has no very distinctive character. The aperture is very nearly one half the length of the shell.

Melania impura. *M. testâ lævi, subcylindraceâ, compressâ, subcrassâ, viridi-corneâ; spirâ subelevatâ; suturis valdè impressis; anfractibus planulatis, supra geniculatis; aperturâ ellipticâ, subcontractâ, ad basim retusâ, intus albidâ; columellâ regulariter incurvâ.*

Hab. Naga, province of South Cumarines, Luzon, Philippines.

Length ·9, diam. ·35 of an inch.

Remarks.—The angle on the superior portion of the whorls gives this species a very distinct aspect. This angle is not very acute, but it is very marked in all the four specimens under examination. The apex in each being decollate, the number of whorls cannot of course be correctly ascertained; there may be about seven. The colour of the epidermis is uniform and of a greenish horn-colour. The aperture is rather more than one-third the length of the shell, and is rounded and retuse at the base.

Melania cochlidium. *M. testâ lævi, subulatâ, subcrassâ, rufo-corneâ; spirâ elevatâ, acuminatâ, ad apicem minutè plicatâ; suturis regulariter impressis; anfractibus tredecim, subcompressis, anfractu ultimo supra angulato, magno; aperturâ latè ovatâ, parvâ, ad basim retusâ, intus albidâ; columellâ regulariter incurvâ.*

Hab. Very small streams, islands of Siquijor and Guimaras, Philippines.

Length 1·5, diam. ·5 of an inch.

Remarks.—This is a very remarkable species, having a single elevated, revolving rib on the superior part of the last whorl, which causes a somewhat impressed channel above. The four specimens under examination from Siquijor are fresh and with perfect epidermis, which varies on the younger specimens to rather a pale horn-colour, while the more mature ones are of a reddish horn-colour. The four from Guimaras are "dead shells," rather more robust, with a portion only of the epidermis remaining, which is rufous. The aperture is about one-fourth of the length of the shell. The operculum has its polar point near the base on the left side.

Melania cincta. *M. testâ lævi, subulatâ, subtenui, rufo-castaneâ; spirâ valdè elevatâ, acuminatâ, ad apicem plicatâ; suturis impressis, linearibus; anfractibus tredecim, subconvexis; anfractu ultimo uno-vittato; aperturâ dilatatâ, ovatâ, intus fusco fasciatâ, ad basim rotundâ; columellâ contortâ.*

Hab. India.

Length 2·2, diam. ·6 of an inch.

Remarks.—The form of this species is very much like that of *Melania aculeus* (nobis), but it is a more attenuate species. The single light band on the lower whorl seems to be peculiar to this species. It is below the middle part of the whorl, and is distinctly visible on the inside in the three specimens under examination. The upper whorls have regular, oblique, somewhat distant folds, on two of the specimens, which are crossed by minute striæ. The lower part of the whorl has indistinct striæ. The aperture is not large, being less than one-fourth the length of the shell, and it is rounded at the base. The columella is much incurved.

Melania lancea. *M. testâ lævi, subulatâ, subtenui, corneâ; spirâ elevatâ, ad apicem striatâ; suturis impressis; anfractibus duodecim, convexis; aperturâ ovatâ, intus albidâ, ad basim rotundâ; columellâ angulariter incurvâ.*

Hab. Ohcataroa, Society Islands.

Length 1·6, diam. ·5 of an inch.

Remarks.—This species is in form somewhat like the *M. aculeus* (nobis), but is a smaller shell and not quite so attenuate. In the four specimens under examination small striæ are distinctly marked on the superior or younger whorls, and on two of them some of the striæ are continuous on the lower whorls. The aperture is not large, being not quite one-third the length of the shell. The columella is much incurved and recurved.

Melania episcopalis. *M. testâ plicatâ, turritâ, subcrassâ, tenebroso-castaneâ; spirâ elevatâ; suturis impressis; anfractibus subconvexis, prope suturam superiorem concavis; plicis raris, subacuminatis; aperturâ magnâ, ellipticâ, intus cærulescente; columellâ contortâ.*

Hab. A sluggish river, Malacca.

Length 2·4, diam. ·8 of an inch.

Remarks.—This is a remarkable and interesting species, and differs from any which has been described, in having rather large and somewhat distant folds rising on the upper part into nodular points, in all the four specimens submitted for examination. The apex of these specimens being truncated, the number of whorls cannot be ascertained. A perfect adult would probably present about ten. The folds are distinct on the four lower whorls only. On the middle of the lower whorl there is a slightly elevated line, below which are about six obscure striæ. The aperture is large, and more than one-third the length of the shell; it is twisted, and has an elongated base. The columella is whitish and very much incurved. The operculum is more spiral than usual, and the polar point more toward the centre.

Melania blatta. *M. testâ plicatâ, elongatè conoideâ, crassâ, castaneo-nigricante; spirâ elevatâ, crebrè costatâ; anfractibus planulatis, infra suturas concavis; plicis crebris ornatis; aperturâ magnâ, ovatâ, supernè angulatâ, ad basim rotundâ, intus cæruleâ; columellâ tortâ, supernè incrassatâ.*

Hab. Rapid river and small streams, Luzon, Philippines.

Length 2·6, diam. ·7 of an inch.

Remarks.—A very dark-coloured and remarkably fine species, with numerous, nearly parallel, perpendicular folds, which number some eighteen or twenty, and exist on every whorl in the eight specimens under examination. The four large ones are truncate, but the younger and more perfect would indicate the existence of about ten whorls. It differs from the *episcopalis* in being more attenuate, in having more folds and a much less twisted columella. The aperture is large, and rather more than one-fourth the length of the shell.

Melania costellaris. *M. testâ plicatâ, supernè striatâ, acuminatâ, subcrassâ, tenebroso-castaneâ; spirâ elevatâ; suturis linearibus; anfractibus decem, subplanulatis; anfractu ultimo magno, geniculato; plicis numerosis; aperturâ parvâ, dilatatâ, ovatâ, supernè angulatâ, ad basim rotundâ, intus cærulescente; columellâ incurvâ.*

Hab. Small streams in the islands of Negros, Tanhay, Siquijor; Philippines.

Length 1·5, diam. ·5 of an inch.

Remarks.—The last whorl being angular gives this species a peculiar and remarkable character, and causes a channel immediately below the suture. Several of the specimens under examination have beautiful delicate impressed lines immediately above the sutures. In

the superior whorls these lines cover the whole surface. The folds terminate on the angle, and are disposed to be nodulous there. The aperture is rounded, angular above, and not quite one-third the length of the shell. The base of the shell is rounded.

MELANIA RECTA. *M. testâ plicatâ, attenuatâ, subcrassâ, tenebroso-castaneâ; spirâ valdè elevatâ; suturis irregulariter impressis, sub-canaliculatis; anfractibus tredecim, subplanulatis; plicis numerosis; aperturâ parvâ, ovatâ, ad basim rotundâ, intus cærulescente; columellâ incurvâ.*

Hab. Very small streams, Siquijor and isle of Negros, Philippines.

Length 1·7, diam. ·5 of an inch.

Remarks.—In many of its characteristics this species is like the *M. costellaris.* It differs entirely, however, in the enlargement of the last whorl, the angle on the superior part of it, and in the channel below the suture, which are important characters in the *costellaris.* Nor has it the minute revolving lines. The folds are remarkably regular and distinct, and number about eleven on each whorl in the eight specimens under examination. On two individuals the epidermis remains quite perfect, and is deposited in regular, revolving striæ. The aperture is about one-third the length of the shell; it is rounded below and angular above, where it is slightly set off from the body of the whorl. The columella is but slightly curved.

MELANIA AUSTRALIS. *M. testâ plicatâ, conicâ, tenui, diaphanâ, rubiginoso-corneâ; spirâ costatâ, prope apicem turbinatâ; suturis impressis; anfractibus septem, convexis, ad basim striatis; plicis numerosis; aperturâ magnâ, ellipticâ, intus salmoniâ; columellâ tortâ; labro supernè emarginato.*

Hab. Victoria river, North Australia.

Length ·9, diam. ·4 of an inch.

Remarks.—This is a very distinct little species, and the sudden enlargement of the third whorl below the apex gives it a somewhat turbinated appearance. The folds do not on the lower whorl reach the suture, and above and below these folds there are minute revolving striæ. The aperture is more than one-third the length of the shell. The outer lip is slightly crenulate and remarkably incurved near to its junction with the body whorl.

MELANIA TORNATELLA. *M. testâ plicatâ, fusiformi, crassâ, corneâ, infernè lineatâ; spirâ acuminatâ; suturis irregulariter impressis; anfractibus novem, convexiusculis, ad apicem mucronatis, in medio concavis; plicis numerosis, crebris; aperturâ constrictâ, elongatâ, intus albâ; labro supernè incisâ; columellâ lævi, crassâ, contortâ, reflexâ.*

Hab. Shallow rivers, Tanhay, isle of Negros, Philippines.

Length ·9, diam. ·35 of an inch.

Remarks.—This belongs to a very remarkable group of *Melania.* The emargination of the outer lip, above the middle of the whorl, is strikingly characteristic of the group. It causes a slight flatness or convexity of the whorl, as well as a curve in the numerous ribs, which cover the whole surface in this species, except where it is superseded

by the transverse lines on the lower part of the whorl. These lines are remarkably parallel, regular and well-impressed, and in the four specimens under examination are six in number. The folds are like ribs, very numerous, closely set, and very distinct. The form of this species, described above, is very like *Tornatella,* and the twist in the columella also resembles that genus. The ribs continue on the apex and give it a scalariform appearance. The aperture is nearly one-half the length of the shell. The edge of the lip, below the emargination, is slightly crenulate. The columella is very thick towards and at the base, where it is so retuse as to permit the inside to be seen. One of the specimens is rubiginose at the base. No operculum accompanied the specimens.

MELANIA RUDIS. *M. testâ plicatâ, subfusiformi, crassâ, corneâ; spirâ subelevatâ; suturis irregulariter impressis; anfractibus planulatis transversim lineis impressis cinctis, supernè canaliculatis; plicis numerosis, crebris; aperturâ parvâ, ovatâ, intus albidâ; labro supernè emarginato; columellâ lævi, subcrassâ, tortâ.*

Hab. Amboyna.

Length 1·1, diam. ·4 of an inch.

Remarks.—Allied to *Melania tornatella,* it forms one of the emarginate group, but differs in the size of the aperture and in the form of the ribs, which are transversely cut by numerous fine lines, in groups, which lines traverse the whole whorls. The aperture is about one-third the length of the shell, and the lip is crenulate. The three specimens under examination are all truncate at the apex, and the number of whorls therefore not ascertained. It has the spiral operculum usual to *Melania.*

MELANIA MICROSTOMA. *M. testâ plicatâ, subfusiformi, subcrassâ, luteo-corneâ; spirâ elevatâ; suturis irregulariter impressis; anfractibus octo, planulatis, transversim lineis impressis cinctis, supernè canaliculatis; plicis numerosis, crebris; aperturâ maximâ, ovatâ, ad basim truncatâ, intus cærulescente; labro supernè emarginato; columellâ lævi, ad basim subcrassâ tortâque.*

Hab. Mountain streams, isle of Negros, Philippines.

Length ·9, diam. ·3 of an inch.

Remarks.—This belongs to the group with emarginate lip, along with *M. rudis* and *M. tornatella.* It is a more slender species, more subulate, and has a smaller aperture than either. It takes more the form of *Terebra.* It has groups of lines which decussate the ribs as in the *rudis.* The aperture is not one-third the length of the shell, and the lip is crenulate. No operculum was received with the shells.

MELANIA TRANSVERSA. *M. testâ plicatâ, pyramidatâ, crassâ, corneâ, castaneo-maculatâ; spirâ elevatâ; suturis irregulariter impressis; anfractibus subconvexis, transversim lineis impressis cinctis; costellis verticalibus raris; aperturâ parvâ, obliquè transversâ, rhomboideâ, intus maculatâ et cærulescente; labro terebræformi, crenulato; columellâ contortâ, supernè incrassatâ, infernè emarginatâ.*

Hab. Guiana.

Length 1·6, diam. ·5 of an inch.

Remarks.—This species is remarkable for the unusual obliquity of its aperture and its auger-shaped lip. In its ribs and decussate striæ it resembles the group consisting of *M. tornatella, M. rudis* and *M. microstoma,* but it has not the emarginate lip and therefore does not belong to them. The emargination at the base of the columella is quite a different character, and is very remarkable in this species, representing as it does *the bite* of the auger. The chestnut-coloured spots are small, but so distinct as to mark the interior of the shell, which is white and thick. The two specimens under examination are both truncate at the apex, and the number of whorls not ascertained, probably about ten. The aperture is rather more than one-fourth the length of the shell. The operculum is spiral, with the polar point nearly in the centre and with at least five revolutions, which is unusual with *Melaniæ.* It is allied to *M. truncata,* Lam. (*semiplicata,* Fer.), but is less cylindrical and differs somewhat in the aperture.

Melania maxima. *M. testâ striatâ, elevato-conoideâ, crassâ, corneâ; spirâ valdè elevatâ; suturis linearibus; anfractibus duodecim, planulatis; striis magnis, raris, tenebrosis; aperturâ magnâ, rhomboideâ, intus albidâ; columellâ valdè contortâ.*

Hab. Copan, Central America.

Length 3, diam. 1·1 inches.

Remarks.—This very large species has a remarkable outline, forming a perfectly regular, rather obtuse cone above. The aperture is very large, and in the youngest of the three specimens the coloured striæ are very distinct within. Under the microscope minute revolving lines may be observed over all the whorls. The aperture is rather more than one-third the length of the shell. The operculum has five revolutions and is very much like that of *M. transversa,* the polar point being nearly central.

Melania Mindoriensis. *M. testâ striatâ, elevato-conoideâ, subtenui, pallidâ, ad apicem acuminatâ; spirâ elevatâ; suturis impressis; anfractibus duodecim, subconvexis, striis crebris; aperturâ magnâ, ellipticâ, intus albâ; columellâ incurvatâ tortâque.*

Hab. Small streams, Puerto Galero, isle of Mindoro, Philippines.

Length 1·9, diam. ·7 of an inch.

Remarks.—The outline of this species is very regular, tapering to a fine point. There are five specimens under examination, all of which have raised striæ over the whole of the body whorl. Some of the specimens have the two next whorls ribbed, which ribs, the striæ decussating, form granular elevations. The remaining whorls are perfectly smooth, with a few delicately impressed transverse lines. Some have brown spots, which towards the apex are more numerous and flammate. The aperture is more than one-third the length of the shell. The operculum has its polar point on the lower edge, and the curved lines of growth do not make one-eighth of a revolution.

Melania indefinita. *M. testâ striatâ, elevato-conicâ, sub-*

crassâ, tenebroso-corneâ; spirâ subelevatâ; suturis valdè impressis; anfractibus convexis, infra suturas impressis, striis crebris impressis; aperturâ parvâ, ovatâ, intus cærulescente, ad basim rotundâ; columellâ regulariter incurvatâ.

Hab. Naga, Luzon, Philippines.

Length 1·6, diam. ·5 of an inch.

Remarks.—The species has a very close resemblance to the striate varieties of *M. Virginica*, Say. The three adult specimens under examination are truncate, and the number of whorls therefore not ascertainable, but probably about nine. The impressed revolving lines are somewhat distant, regular and delicate. Between these, under the microscope, may be seen very minute revolving striæ. The aperture is about one-fourth the length of the shell. The operculum has its polar point near to the edge of the lower margin.

Melania Luzoniensis. *M. testâ striatâ, conicâ, subtenui, tenebroso-corneâ; spirâ erosâ; suturis impressis; anfractibus sex, convexiusculis, transversim lineis rugosis impressis cinctis; aperturâ magnâ, elongato-ellipticâ, intus rubiginosâ; columellâ albâ tortâque.*

Hab. Small streams, Calanang, province of Bai, Philippines.

Length 1·1, diam. ·5 of an inch.

Remarks.—There is no peculiarity in the outline of this species, and the most striking character is perhaps in the impressed lines, which are somewhat distant, having minute numerous wrinkles across the groove. They are very distinctly visible under the microscope, and do not seem to have been observed in any other species. The superior part of the whorls is disposed to be granose, and one specimen has four rows of granules. Immediately under the sutures there is a yellow line. The aperture is one-half the length of the shell. The operculum has its polar point close to the lower margin.

Melania albescens. *M. testâ striatâ, elevato-conicâ, subtenui, albidâ, lineis rufis interruptis ornatâ; spirâ acuminatâ; suturis impressis; anfractibus undecim, planiusculis, lineis transversis vix impressis; aperturâ ovato-oblongâ, intus albidâ, rufo-maculatâ, ad basim rotundâ; columellâ incurvâ.*

Hab. Small streams, isles of Guimaras, Negros and Siquijor, Philippines.

Length 2·5, diam. ·9 of an inch.

Remarks.—This is a very regularly formed and graceful species, with rather a high and tapering spire. The impressed revolving striæ are chiefly on the body whorl. The most striking characteristic is the numerous interrupted delicate brown lines, which cover nearly the whole of the whorls and are closer and better defined towards the apex. In some specimens there are beautiful brown spots on a white ground, below the sutures. The aperture is about one-third the length of the shell. The operculum has its polar point close to the lower margin on the left. There is a very great difference in the size and thickness of the specimens. Some of the old are very large, heavy, and covered with the oxide of iron, showing

beneath a brown epidermis and white nacre. In these the peritreme is very thick, and the columella more remarkably thick than heretofore noticed in any *Melanian*.

Melania hastula. *M. testâ striatâ, nonnunquam plicatâ, elongatè subulatâ, diaphanâ, tenui, fuscâ, striis transversis crebris costulas decussantibus; spirâ acuminatâ; suturis linearibus; anfractibus plano-convexis; aperturâ parvulâ; ovatâ, intus vel fuscâ vel albidâ; columellâ incurvâ tortâque.*

Hab. Various streams of Siquijor, Cagayan, Mindanao, and other Philippine Islands.

Length 3·3, diam. ·8 of an inch.

Remarks.—A very attenuate and greatly varied species, some being smooth with few striæ, others with striæ over the whole surface, and others again with numerous folds. In some of the specimens under examination the apex is eroded in a very unusual manner, the outer portion of the whorls there being so much decomposed as to present little more than the central column. Some of the specimens are dark brown, others are horn-colour with brown spots. There are probably about twelve whorls. Although some of the specimens have more or less distinct, somewhat distant folds, there are others which have no folds whatever. This species is placed among the striate group, as striæ are found more or less developed on every specimen. The striæ immediately below the suture are more deeply impressed and cause a slight groove. A variety from Camiguing is flatter on the whorls and less disposed to plication. The aperture is not quite one-fourth the length of the shell, is rather open and somewhat patulous below. The operculum has its polar point near to the margin on the left.

Melania juncea. *M. testâ striatâ, elongatè subulatâ, tenui, tenebroso-fuscâ, infra suturas luteo-lineatâ; spirâ attenuatâ; suturis valdè impressis, anfractibus undecim, convexis, lineis transversis impressis; aperturâ parvulâ, ovatâ, intus fuscâ; columellâ valdè incurvâ contortâque.*

Hab. Lake of Taal, province of Batanos, and small streams in Luzon, Philippines.

Length 2, diam. ·5 of an inch.

Remarks.—An attenuate and gracefully formed species. Some of the specimens are of a dark rich brown, others are flammate. Two have very small incipient folds on nearly all the whorls, others have a few towards the apex. From the same locality are four specimens, which, while they differ but little in form, are very different in colour, being yellowish, with longitudinal flammate brown marks. This variety answers very closely to *M. flammulata*, Von dem Busch, 'Conchylien,' &c. by Dr. Philippi, tab. 1. fig. 3, 4. The aperture is about one-fourth the length of the shell and is rather small, with a patulous lip having a whitish border. The operculum has its polar point rather near to the margin. Gualtierus (tab. 6. fig. G) gives a drawing of a freshwater shell closely resembling this variety. Another variety is rather thinner, diaphanous, horn-colour, and obscurely maculate.

MELANIA CONULUS. *M. testá minutè et crebrissimè striatá, conicá, subtenui, fuscá; spirá obtusá; suturis linearibus; anfractibus septem, planulatis, uno-vittatis; aperturá elongato-ovatá, ad basim angulatá, intus fuscá; columellá tortá.*

Hab. Small streams, Fernando Po, West Africa.

Length 1·4, diam. ·5 of an inch.

Remarks.—This interesting species is remarkable for its peculiar striæ, which cover the whole surface of all the whorls. The lines are irregular, and so minute as to require the microscope to detect them. A little above the middle of the whorl there is an obscure, dark, rather broad band. The middle of the whorl is somewhat angular. The aperture is not quite one-half the length of the shell, and is somewhat angular below.

MELANIA OBRUTA. *M. testá striatá, conoideá, crassá, bivittatá, fuscá; spirá subelevatá; suturis impressis; anfractibus septem, convexiusculis, lineis crebris elevatis; aperturá parvulá, subpatulá, intus albá et bivittatá, ad basim emarginatá et retusá; labro crenulato et arcuato.*

Hab. ——?

Length 1·3, diam. ·5 of an inch.

Remarks.—In general form and outline this species is very like to the striate variety of *M. Virginica*, Say. It differs in being thicker and in having a crenulate and patulous lip. In the four specimens submitted, the two dark brown bands are beautifully distinct inside, and stop short of the margin. Three specimens have a suddenly enlarged body whorl. Two of the specimens have obscure, longitudinal brown marks. The aperture is about one-third the length of the shell, is very much curved on the edge of the lip, and disposed to be canaliculate at the base. The striæ are coarse and elevated.

MELANIA TURRICULUS. *M. testá striatá, conoideá, subtenui, obscurè maculatá, corneá, spirá subelevatá; suturis impressis; anfractibus novem, convexiusculis, lineis subraris impressis, supernè angulatis; aperturá parvá, subconstrictá, intus albidá et obscurè maculatá, ad basim rotundá; columellá regulariter curvatá.*

Hab. Small rivers, Calanang, province of Bai, Luzon, Philippines.

Length 1·2, diam. ·4 of an inch.

Remarks.—This species, like *M. obruta*, resembles in size and outline very closely *M. Virginica*, Say. It differs from the former in being less thick, in being maculate and not banded, and in having impressed lines. It differs from the latter in being maculate, and in being angular immediately under the suture. The aperture is rather more than one-third the length of the shell, angular above and rounded below. The operculum has its polar point somewhat removed from the lower margin.

MELANIA APIS. *M. testá striatá, conicá, tenui, obscurè granosá, rufo-castaneá; spirá obtusá; suturis irregulariter impressis; anfractibus convexis, lineis paucis elevatis; aperturá parvá, sub-*

rotundâ, intus rufâ, ad basim angulatâ; labro repando, rufo-marginato; columellâ incrassatâ.

Hab. Marshy places, Vera Cruz, Mexico.

Length ·8, diam. ·3 of an inch.

Remarks.—Neither of the four specimens under examination are perfect, all being much eroded at the apex. Under the microscope the surface may be observed to be papillose, a character rarely found in this genus, though not very uncommon in *Helix*. The aperture is rather more than one-third the length of the shell and is unusually rotund. The rufous line surrounds the peritreme. The aperture is reddish inside.

[To be continued.]

BOTANICAL SOCIETY OF EDINBURGH.

Thursday, 13th Nov., 1851.—Prof. Balfour, President, in the Chair.

The following papers were read:—

1. "On the Gulf Weed (*Sargassum bacciferum*)," by Mr. Samuel Mossman.

This was a lecture giving an account of all that is known on the subject of the Gulf Weed and Sargasso Sea, and professedly contained little or no original information. We have therefore thought that an abstract would unnecessarily occupy space.

2. "On the Correspondence between the Angles formed by the Veins of the Leaves, and those formed by the Branches of the Stem," by Mr. William Mitchell. Communicated by the Rev. Dr. M'Cosh.

Having been informed that the Rev. Dr. M'Cosh had thrown out the idea that a plant, considered morphologically, may be regarded as a unity; and, in proof of this view, had produced many examples among forest trees, pointing to the similarity of the ramification of the branches and the venation of the leaves, the general correspondence of the angles in both, and the agreement of the form of the leaf, or leafage from one point, with that of the whole tree, I felt inclined to test the truth of the theory, so far as I was able, by its application to herbaceous plants. For this purpose I examined a great number of these plants, and found the results, generally, the same as those given in the following list, which contains a few of the most carefully measured of our common wild flowers:—

Tanacetum vulgare—The angle which the branches make with the stem is 45 deg.; and it is equal to that which the side veins of the leaf make with the central vein. In the other examples we shall express the two equal angles by the term "normal angle."

Euphrasia officinalis—Normal angle, 45 deg. average.

Scabiosa succisa—N. A., 40 deg. upper branches and veins; 35 deg. lower veins and root-leaves.

Centaurea nigra—N. A., 55 deg. average.

Fumaria officinalis—N. A., 60 deg.

Spiræa ulmaria—N. A., 35 deg.; terminal branches and veins somewhat less.

Senecio vulgaris—N. A., 30 deg.

Gentiana campestris—N. A., about 20 deg.

Chrysanthemum segetum—N. A., 35 deg.
Veronica Beccabunga—N. A., 45 deg.
Polygonum Persicaria—N. A., 40 deg.
Apargia autumnalis—N. A., about 50 deg.
Carduus arvensis—N. A., 35 deg.
Lapsana communis—N. A., about 40 deg.
Lamium album and *L. purpureum*—N. A., 45 deg. average.
Geum urbanum—N. A., 35 deg. average.
Vicia lutea—N. A., for branches and leaflets, about 45 deg.
Achillea Millefolium—N. A., for branches and divisions of leaflets, 35 deg.
Veronica Chamædrys—N. A. varies from 35 deg. to 45 deg.
Teucrium Scorodonia—N. A., 35 deg.
Anthriscus sylvestris—N. A., about 45 deg.
Mentha arvensis—N. A., 40 deg. average.
Urtica urens—N. A., 49 deg.
Atriplex patula—N. A., 45 deg. average.

These angles have been deduced from the measurement of numerous specimens in different localities, and where the word 'average' is added, it is to be understood that the angles of branches and veins of leaves vary equally, and the one stated is taken about the middle of the plant and the middle of the leaf.

Assuming the foregoing observations to have been accurately made, it would appear that Dr. M'Cosh's views are borne out in a very remarkable manner, and demand still further investigation. We find in plants divisions and subdivisions carried out with surprising regularity, so as often to give the leaf a form resembling that of the whole plant, and we find on measuring these successive divisions that equal angles have generally been maintained throughout.

In sending the paper, Dr. M'Cosh writes as follows :—

In July I spoke with considerable hesitation of the angular measurements. I can now state with great confidence, that there is a most wonderful correspondence between the angle of the venation of the leaf and that of the ramification of the stems. My plan is to *take a freely growing branch from a healthy tree, and measure the angle of the branchlets.* The careful measurement of a few such branches will give the normal angle of ramification, and it will be found to be much the same as the angle of venation. I have also an idea, that all spines are at a wide angle, and that branches tending to become spines are at a wider angle than the normal one.

Mr. Mitchell is a schoolmaster at Edzell; he is possessed of extensive scientific knowledge, and is a respectable botanist.

3. "Tables illustrative of the Morphology of Plants," by the Rev. Dr. M'Cosh.

I. Woody Plants whose leaves have little or no petiole, and which have branches along the axis from near the root.

Boxwood.	Holly	Beech.
Privet.	Philadelphus.	Oak.
Bay Laurel.	Laurustinus.	Elm.
Portugal Laurel.	Arbutus.	Alder (very small).

The Portugal Laurel has a short petiole, and also a short unbranched axis.

The Beech and Oak are acknowledged by all woodmen to be branched from the root or near the root, when growing freely.

II. Woody Plants, whose leaves have a pretty long petiole, and which have a considerable extent of unbranched axis from the root upwards.

Cherry.	Sycamore.	Laburnum.
Apple.	Maple.	Birch.
Pear.	Horse Chestnut.	Lilac.
Lime.	Service-tree.	

I cannot say how this law applies to plants which have not a woody structure.

III. Plants whose leaves have several ribs or main veins proceeding from the base of the leaf, and whose branches tend to form a whorl round the axis.

Sycamore.	Ivy.	Nettle.
Maple.	Ground Ivy.	Alchemilla.
Currant.	Pelargonium.	Mallow.
Gooseberry.	Geranium.	Potentilla.
Guelder Rose.	Hollyhock.	Tussilago.
Philadelphus.	Rhubarb.	Cineraria.
Vine.	Indian Cress.	Violet.

IV. Plants with separate leaves or leaflets springing from nearly one point, and with branches of a similar kind.

Laburnum (leaflets in threes).	Common Barberry.	Ranunculus.
Broom (leaflets in threes).	Alchemilla alpina.	Fuchsia.
Rhododendron ponticum.	Lupin.	Columbine.
Azalea (tendency to verticillation in the leaves).	Wood Anemone.	

In speaking of whorled branches, I mean, that either the leafstalk, or the branches, properly so called, *one or both*, tend to form a whorl round the axis.

V. Plants of which the branches and the veins of the leaves spring at the same angle.

TREES.

	Deg.		Deg.		Deg.
Horse Chestnut	50·55	Privet	50	Rose	50
Service-tree	48	Bird Cherry	60·64	Sycamore	45
Siberian Lilac	40	Lime	40	Cherry	50
White Lilac (at widest)	58	Hazel	42·43	Ash	60
Broad-leaved Spindle-tree	40	Jessamine	40·45	Elm	50
Raspberry	42	Mountain Ash	45	Alder	50
Portugal Laurel	50·60	Rhododendron	60	Box	60
Bay Laurel	50·60	Holly	55	Oak	50
Laburnum (small branches)	60	Red Dog-wood	45	Beech	45
Grey Willow	60·64	Osier Willow	45·50	Orange	55
Pyrus domestica	35	Guelder Rose	45	Birch	48·35

HERBACEOUS PLANTS.

	Deg.		Deg.		Deg.
China Aster	28·30	Marigold	38·40	Lupin	40·44
Antirrhinum	28·30	Rose Willow	30·35	Phlox	40·48
Ten-week Stock	35·38	Zinnia	23·25	Poppy	20·25
Xeranthemum lucidum	18·20	Fuchsia	60	Verbena	35·38
Solidago Virgaurea	30	Valerian	25	Columbine	25·28
Clarkia elegans	36·40	Salvia (red)	35	Mallow	36·38
Queen of the Meadow	30·35	Pentstemon	38	Alonsoa	38·40
Wild Geranium	50·64				

In the leaves of many trees the small veins come off at a wider angle than the large veins. But it may be observed that in several trees, the small branches come off at a wider angle than the large branches, as in the oak for instance. What woodmen in this part of the country call *spray*, seems in the tree to correspond to the small veins in the leaf.

4. "On Fossil Woods from Antigua and Australia." by Mr. R. Bryson. The author made some remarks on the process of silicification, and pointed out the difference of appearance presented by the woods. Some were completely opalized and hard throughout; others had portions either external or internal which were less completely silicified, and in a friable state.

MISCELLANEOUS.

Notice of the Occurrence of the Black Tern, Sterna nigra, *Linn., near Coldstream.* By JOHN ALEXANDER SMITH, M.D.*

THE specimen of the black tern, *Sterna nigra,* Linn., which I now exhibit to the Society was killed in the beginning of July last, near Wark boat-house on the river Tweed, about two miles or so above the town of Coldstream; the person who shot it informed me that it was flying in company with several other birds apparently of the same kind, but the bird itself was quite unknown to him. It is easily distinguished from the other terns by the dark character of its plumage, and its tail being only slightly forked; some naturalists indeed, from this last character, and other slighter peculiarities, are inclined to separate it into a distinct genus. In this individual the bill, head and neck are black; the upper parts of the body and tail of a dingy bluish gray, very slightly tinged with brown; outer web of first quill nearly black, rest of quills grayish black, their shafts like those of the tail-feathers white; throat, breast, sides and abdomen of a grayish black; lower wing-coverts white, with a slight brownish tinge; vent and lower tail-coverts white; legs and feet dark reddish brown, and feet less webbed than other terns. The bird is about $9\frac{1}{2}$ inches in length, and the length of wing from carpal joint to extremity of first primary is about $8\frac{1}{2}$ inches. The male and female are said to be alike in their plumage; and the young have the forehead, cheeks, throat and whole of the under surface pure white, and the colours of the

* Read to the Royal Physical Society of Edinburgh, Dec. 3, 1851.

upper parts mixed with brown. Though this, therefore, seems to be an adult bird, still the colours are not so pure and dark as in other specimens which I have examined from the south of England; and I am inclined to consider it as an adult that has just assumed the mature plumage. Like the other terns it is a summer visitor to Britain, and unlike them it frequents rivers, freshwater ponds, and marshes, in preference to the sea-coast, breeding among the grass and rushes of their borders, and feeding principally on the varied insect-food which abounds there.

It is described as being common on the marshes of Holland and other northern parts of Europe, extending even as far as the Arctic circle; but in Britain it is found principally in the south-eastern districts of England, where it is now by no means so common as it formerly was. It "*is a rare bird in the north of England, and is not found in Scotland.*" (Yarrell's Brit. Birds.) Jardine and MacGillivray both allude to it *as not having been met with in Scotland*; so that, as far as I am aware, this is the first specimen which has been described as occurring so far to the north in Britain; and I am inclined of course to claim it for Scotland, as in pursuit of its insect prey it hunted over both sides of the river Tweed, which there forms the southern boundary of our ancient northern kingdom!

P.S.—I was informed by a friend at the meeting of the Society, that a specimen of this bird had been shot some years ago in East Lothian; so there can be no doubt of its occurrence at least occasionally in Scotland.

On the Circulation of the Blood, and Nutrition in Insects. By M. Emile Blanchard.

It has long been known that silkworms fed upon leaves powdered with madder produced rose-coloured cocoons, whilst those fed upon leaves sprinkled with indigo produced blue cocoons; but these larvæ had never been examined anatomically. At the scientific congress held at Genoa a few years since, however, Prof. Alessandrini of Bologna stated that he had detected the blue colour in the tracheæ of some silkworms which had been fed on leaves powdered with indigo. He brought forward this fact as being unable to explain it, requesting his colleagues to repeat the experiment. M. Bassi, having undertaken this work, announced the following year, that silkworms which had eaten coloured substances certainly exhibited the same colour in their tracheæ, but that the colour was not in the interior of the respiratory tubes, but rather between the membranes forming their walls.

When I became acquainted with these inquiries, they appeared to me to be of too much importance to be allowed to pass without repetition. I therefore took a quantity of caterpillars, particularly those of the peacock butterfly (*Vanessa Io*), and placed them in two boxes, furnished with leaves, powdered, in the one with madder, in the other with indigo. After continuing this diet for several days, I dissected some of my caterpillars, and was convinced that some of

them presented rose-coloured, and others blue tracheæ; the viscera and the muscles had preserved their natural colour. This was M. Bassi's experiment, and I had verified his result; but I wished to follow out this experiment in a more complete manner. Many caterpillars have the blood of a slight greenish tint, or of a brownish green, which appears in some respects unfavourable for showing the effects of coloured substances introduced by the alimentary canal. So, although I did not doubt in the least that in my caterpillars the blood was charged with the colour of the indigo or madder, and that this tint only appeared in the tracheæ because there alone the liquid was imprisoned, I thought it better to choose for my further experiments insects in which the blood is colourless and of which the white integuments would render observation more easy. The larvæ of the cockchafer (*Melolontha vulgaris*) appeared to me to fulfill these conditions pretty well. I placed several of these in some earth filled with vegetable matter and mixed partly with madder and partly with indigo. At the end of several days, the blood of those which had eaten madder had acquired a rosy tint, although this colour was but faint, the digestive juices having acted less powerfully upon this substance in these insects than in the larvæ of Lepidoptera; but the blood of those which had eaten indigo had acquired a very marked blue tint, this colour being perfectly distinct through the integuments of the insects. It was evident immediately that the dorsal vessel was filled with perfectly blue blood, and the nutritious fluid was distinctly visible in all the cavities of the body, coloured in a similar manner.

When an insect has been subjected to an indigo diet only for a few days, the blood becomes perceptibly blue; this is particularly manifest in those parts where it is present in considerable quantity, as in the abdominal cavity and even in the dorsal vessel; but in the space between the membranes of the tracheæ where it can only form a very thin stratum, the tint is still very faint. By continuing the same diet, the blood becomes more and more coloured, and then shows itself throughout in the most distinct manner; but still, neither the muscles nor the viscera become tinged, these parts retaining their usual whiteness. The tracheæ constantly present the deepest tint at their base, becoming gradually paler to the extremity; this is readily explained by the gradual diminution of the quantity of fluid interposed between the trachean membranes.

Thus the passage of the blood between the walls of the tracheæ, as well as the entire course of the circulation, as I had proved by means of injections, made either through the dorsal vessel or through one of the large cavities of the body into which the blood flows, becomes as evident as possible; for it is the blood itself, in the living insect, which, charged with colouring matter, renders the facts visible to every one.

It is clear that observations on these processes of alimentation will soon leave not the least doubt on the course of the blood in insects; for perhaps no demonstration can render the facts more evident, than that furnished by the experiments that I have just detailed. We see clearly that nutritive matters pass into the blood contained in the

abdominal cavity by transuding through the walls of the intestinal canal. Through the integuments of the larvæ of *Melolontha,* of which the blood has been charged with colouring matter, we may perceive, without difficulty, that the nutritive fluid bathes the viscera, that there exists on each side of the body a tolerably distinctly circumscribed current, and that the blood returns to the heart through the transverse canals which I have formerly described and which run through the grooves formed by the junction of the segments, where they are bounded by a certain quantity of cellular tissue. And here I have been able to perceive that these canals are in communication with the pericardiac chamber, from which the blood re-enters the heart, as in the Arachnida and Crustacea.—*Comptes Rendus,* Oct. 6, 1851.

ON THE OCCURRENCE OF EOLIS LANDSBURGII.

To the Editors of the Annals of Natural History.

GENTLEMEN,

The rare and beautiful *Eolis Landsburgii* of Messrs. Alder and Hancock's Monograph on the Nudibranchiata, has lately occurred to me on the Devonshire coast; and as two specimens only, I believe, have been previously discovered, and those in different parts of the kingdom, the capture may perhaps be worth a record in the 'Annals.' A single specimen of this exquisite little mollusk was taken in a rock-pool near Exmouth. Its bright amethystine colour at once attracted my notice. It appeared like a brilliant little gem on the dark foliage of the weed.

In the course of two or three days it deposited on the side of the bottle in which it was confined a delicate coil of *ova.*

The specimen from which the description and figure in the 'British Nudibranchiata' were taken, was obtained on the Ayrshire coast, and Mr. Alder informs me that a second has since been procured on the Cheshire shore.

I remain, Gentlemen, your obedient servant,

Exeter. THOMAS HINCKS.

DISCOVERY OF THE REMAINS OF SEVERAL ORDERS OF REPTILES IN THE OLD RED SANDSTONE AND SHALES OF SCOTLAND.

At the meeting of the Geological Society on the 17th, a memoir on the discovery of fossil footsteps by Capt. Lambart Brickenden, and of a reptile by Patrick Duff, Esq., and described by Dr. Mantell, was announced for reading; but in consequence of the protracted discussion on a most important paper on Climate by the President, the title only of this communication was read, and the consideration of the novel and highly interesting subject was postponed till the next meeting, January 7. The specimen discovered by Mr. Duff is a small four-footed reptile, not exceeding, when living, 6 or 7 inches, and was exhibited, with drawings illustrative of its anatomy, by Dr. Mantell, to whom Mr. Duff had transmitted it for examination and description. The fossil is a distinct impression of a great part of the

skeleton, with a mutilated portion of the cranium; its general aspect is that of a small land lizard, but its osteological characters are peculiar, exhibiting a blending of true lacertian with batrachian attributes. If the animal prove upon the discovery of bones to be a true lizard, it must have closely resembled the green lizards; if, on the other hand, it turn out to be an aquatic salamander, it must have been very similar in form, and doubtless in habits, to our Tritons, but with better-formed limbs, and more expanded dorsal and costal regions. Dr. Mantell has named it *Telerpeton** *Elginense,* to indicate its remote antiquity, and the locality whence it was obtained. Dr. Mantell also placed before the Society specimens of fossil ova, hitherto supposed to be eggs of gasteropodous mollusks, from the Lower Devonian shales of Forfarshire. These Dr. Mantell stated he had reason to conclude are unquestionably ova of batrachian reptiles: those in clusters belong to animals of the frog-tribe; and others that occur singly or in pairs, and often attached to a leaf, resemble those of aquatic salamanders.

Notes on the Habits of the Crustacea of the Antilles. By Dr. P. Duchassaing of Panama.

During his sojourn in the Antilles, Dr. Duchassaing studied the habits of several Crustacea, principally those of the terrestrial crabs. The following facts are extracted from his work.

The *Cardisomata* of Latreille, known at the Antilles under the name of *Land Crabs* or *White Crabs,* are omnivorous, devouring everything they chance to meet with; they live generally in the muddy ground of the mangrove swamps, where their nourishment consists almost exclusively of the sweet fruit of the corkwood (*Annona palustris*), which grows in quantities in those places. They dig themselves holes in the mud and withdraw into them at the least noise. Those which live in the vicinity of the cemeteries dig burrows which go to the bodies and make these their food. The places of sepulture in the Antilles are thus pierced in all directions by the burrows of these animals. Nevertheless the *Cardisoma carnifex* is much sought after as food in the Antilles; its flesh is more delicate than that of the *Gecarcini.* Care is taken only to use those for eating which live in the mangrove swamps, far from the burial-places; these are kept in close places where they are fattened with broken victuals. They are caught with the same trap that is used for taking rats; this consists of a box with a sliding door, in which a piece of the fruit of the *Annona* is placed as bait, and when the animal touches this, the door falls and it is caught in the box. But the time when their pursuit is most productive is during the heavy rains of the winter, when the swamps are inundated; the animals then being unable to remain in their holes, withdraw in thousands to the nearest dry places, when they are taken in great quantities, and their flesh is particularly esteemed.

The *Ucæ* of Latreille are also very abundant in the Antilles; they

* τῆλε, procul; ἕρπετον, reptilis.

live in the same localities as the preceding, and in the same manner. They are taken in the same traps and in great quantities, but their flesh has a strong taste, and is only eaten by the negroes.

The *Gecarcini,* frequently called violet crabs, painted crabs, and "*tourlouroux,*" are of numerous species. The *Gecarcinus lateralis* is the most common, and to it the name of "*tourlourou*" properly belongs. It lives in dry woods on the sea-coast, and hides under stones and trunks of trees or in holes; often, as is also the case with *Cardisoma carnifex* and *Uca una,* even under the flooring of houses. It is only esteemed as food at the period of spawning, because then the ovaries are dilated with eggs; and it is only at this period that they are taken, which is so much the more readily done, because then great numbers of them are about in troops.

It is said that the *Gecarcini* as well as the *Cardisoma carnifex* have occasionally poisonous properties; but the flesh of these animals being heavy and the epicures eating sometimes great quantities of them, it is probable that it is generally indigestion that is produced, particularly as these derangements bear a considerable resemblance to some cases of poisoning. It has been pretended that the crabs acquire this venomous property after eating the fruit of the manchineel-tree; but in answer to this it is stated that the fruit of the manchineel is not ripe at the period when the crabs are eaten, and it must be observed that this fruit does not fall to the ground until it has arrived at the extreme of ripeness.

The *Gelasimi* inhabit the most muddy places they can find, where a soft dirt, composed of decomposed leaves, allows them to dig their retreats easily. When these animals are frightened at anything, they retreat towards their burrows, with their large claw raised: they require a great quantity of moisture; for in the event of a long drought, the mud of the swamps becoming dried up, they nearly all die, and so great is their number in some places, that when this is the case the air becomes contaminated by the emanations from their bodies. Their numbers, in fact, are so prodigious, that in some districts one may see spaces of two or three leagues perforated with the burrows of these animals.

The *Sesarma Pisonii* lives on the roots of the mangroves. When it perceives the approach of danger it ascends even to the topmost branches of these trees, or else descends along the roots until it is covered by the water.

The *Grapsus pictus* inhabits rocks on the sea-shore, where it is continually engaged in watching for prey; for this purpose it keeps five or six lines from the surface of the sea, and seizes upon anything that swims past. Its feet are so disposed and covered with asperities, that it runs with great swiftness over the most inclined rocks, and can only be taken by surprise: when every other place of retreat is cut off, it throws itself into the water. This animal changes its skin on the rocks which it inhabits; at that time it is much less active and can be caught more readily. The places inhabited by the *Grapsi* are covered with their brilliant coats.—*Bibl. Univ. de Genève,* 1851, p. 337.

OBITUARY.—MR. SAMUEL VEALL.

Died at Boston, Lincolnshire, on the 17th of August 1851, aged 71 years.

It may be said of him, that in youth, and until his mental powers had become enfeebled by age, he was diligent in the attainment of knowledge. From his early days he was fond of books and experimental science. At a time when philosophy was by no means fashionable, especially about 1808 and 1809, he was amongst the earliest projectors and friends of a Literary and Philosophical Society in Boston, his native town. In connection with this Society, he became Secretary, and delivered lectures on Electricity, Optics, Galvanism, &c., and it is believed continued his efforts so long as he could find coadjutors to act with him. He engaged in those pursuits simply for the improvement of himself and his neighbours.

It may well be presumed, that his Meteorological Journal, which he kept methodically and perseveringly for many years, and communicated to this Magazine from its commencement, has aided in throwing some light upon the laws which govern the changes of the atmosphere, and may have induced others to contribute in like manner to meteorological science.

He was considerate to a fault of those whom he employed in business; and though often injured himself, he was not known to act injuriously towards others. Punctiliously honest, he even made scruples where many individuals esteemed upright would see nothing to blame. He has left a widow and family to revere his memory and imitate his virtues.

METEOROLOGICAL OBSERVATIONS FOR NOV. 1851.

Chiswick.—November 1. Overcast: very fine: clear: frosty. 2. Fine: hail-shower. 3. Hoar-frost: very fine: cloudy: rain. 4. Rain: fine, but cold. 5. Clear and frosty: slight rain at night. 6. Clear and fine: cloudy. 7. Cloudy and cold. 8. Fine: rain. 9. Foggy: fine: rain. 10. Very fine: drizzly at night. 11, 12. Very fine. 13. Foggy. 14. Clear and fine. 15. Frosty: very fine: clear. 16. Frosty: clear and fine: cloudy. 17. Clear and cold: frosty at night. 18. Clear and cold: severe frost at night. 19. Sharp frost: fine: cloudy. 20. Clear and frosty: very clear throughout. 21. Overcast. 22. Cloudy: fine. 23. Frosty: clear and fine: rain at night. 24. Densely clouded: foggy at night. 25. Frosty: very fine. 26. Foggy. 27. Hazy. 28. Frosty: very fine: frosty. 29. Frosty, with fog: fine: foggy. 30. Dense fog.

Mean temperature of the month	35°·86
Mean temperature of Nov. 1850	45 ·29
Mean temperature of Nov. for the last twenty-five years	43 ·43
Average amount of rain in Nov.	2·35 inches.

Boston.—Nov. 1. Fine. 2. Rain: rain early A.M. 3, 4. Fine. 5, 6. Fine: rain P.M. 7. Cloudy. 8. Cloudy: rain P.M. 9, 10. Fine: rain P.M. 11. Foggy. 12—16. Fine. 17. Fine: snow P.M. 18. Fine. 19. Cloudy. 20. Fine. 21. Cloudy: rain P.M. 22. Cloudy: rain A.M. and P.M. 23. Cloudy: rain P.M. 24, 25. Fine. 26. Cloudy. 27. Fine. 28. Cloudy. 29. Fine. 30. Foggy.

Sandwick Manse, Orkney.—Nov. 1, 2. Showers. 3. Snow-showers. 4. Snow-showers: rain. 5. Showers: cloudy. 6. Showers: cloudy: rain. 7. Rain: drizzle. 8. Drizzle. 9. Showers. 10. Bright: showers. 11. Bright: cloudy. 12. Cloudy. 13. Showers: hail-showers. 14. Sleet-showers: rain. 15. Showers: cloudy. 16. Sleet-showers: snow-showers. 17. Hail-showers: cloudy. 18. Cloudy: clear. 19. Cloudy: drops. 20. Bright: rain. 21. Showers: clear: aurora. 22. Bright: cloudy. 23. Cloudy: rain. 24. Clear: frost: aurora. 25. Frost: rain: clear. 26. Showers: fine. 27, 28. Fine: frost: fine. 29. Fine: frost: fine: showers. 30. Fine: frost: fine.

by Mr. Veall, *at* Boston; *and by the* Rev. C. Clouston, *at Sandwick Manse*, Orkney.

Days of Month	Barometer.					Thermometer.					Wind.			Rain.		
	Chiswick.		Boston. 8¾ a.m.	Orkney, Sandwick.		Chiswick.		Boston. 8¾ a.m.	Orkney, Sandwick.		Chiswick. 1 p.m.	Boston.	Orkney, Sandwick.	Chiswick.	Boston.	Orkney, Sandwick.
1851. Nov.	Max.	Min.		9¼ a.m.	8½ p.m.	Max.	Min.		9¼ a.m.	8½ p.m.						
1.	29.613	29.559	29.22	29.22	29.08	52	28	41.5	42	39	nw.	w.	sw.	.02	......	.19
2.	29.550	29.336	29.00	29.07	29.40	50	31	44	40	39	n.	w.	nnw.	.01	.07	.47
3.	29.920	29.759	29.47	29.60	29.68	45	26	34	35	35½	w.	nw.	nnw.	.06	......	.15
4.	30.002	29.762	29.59	29.82	29.95	40	22	30	37	40	n.	n.	w.	.02	......	.19
5.	30.084	29.884	29.70	29.80	29.97	45	37	31.5	47	42	w.	nw.	n.	.02	......	.19
6.	29.870	29.846	29.56	29.98	30.07	47	38	40	42	41	nw.	nw.	calm	......	.03	.05
7.	29.835	29.770	29.55	29.91	29.88	47	35	41	45	49	ne.	n.	n.	......	.26	.26
○ 8.	29.874	29.835	29.59	29.82	29.73	48	38	41	49	50	ne.	nw.	nw.	.07	......	.08
9.	29.869	29.803	29.58	29.70	29.51	43	39	41	46	45½	se.	s.	w.	.14	.18	.12
10.	29.757	29.626	29.34	29.61	30.06	49	28	39	44	46	ne.	n.	n.	.01	.20	.53
11.	30.120	30.005	29.75	30.18	30.18	49	30	34	46	46	n.	nnw.	w.	......	.02	.09
12.	30.347	30.230	29.94	30.24	30.25	46	29	36.5	45	46	n.	n.	w.	.02	......	.05
13.	30.434	30.345	30.09	30.17	30.26	47	36	34	46	37	sw.	w.	n.	......	......	.10
14.	30.289	30.100	30.00	30.32	30.16	44	25	36	39	39	n.	n.	s.	......	......	.13
15.	30.022	29.946	29.72	29.96	29.96	41	19	33	40½	41	w.	nw.	nw.	......	......	.29
☾ 16.	29.845	29.815	29.56	29.92	29.98	42	26	34	35	31	n.	nw.	nnw.	......	......	.06
17.	29.821	29.701	29.55	29.86	29.94	35	27	28.5	32	37	n.	nnw.	n.	......	......	......
18.	29.871	29.839	29.60	29.91	29.88	41	16	31	34	32	n.	nw.	calm	......	.22	.09
19.	29.849	29.644	29.57	29.66	29.76	37	25	30	37	37	sw.	wnw.	se.	......	......	......
20.	30.062	29.861	29.63	29.95	29.72	43	24	31	39	48	n.	nw.	w.	......	......	.03
21.	29.930	29.836	29.56	29.83	30.06	46	34	37	40½	40	w.	w.	n.	......	......	.21
22.	30.149	29.998	29.72	30.17	30.11	45	25	37.5	41	44	n.	nnw.	w.	......	.03	.08
● 23.	30.133	29.855	29.80	29.66	29.40	45	32	32.5	40½	41½	w.	nw.	w.	.18	.04	......
24.	29.493	29.452	29.16	29.31	29.36	46	23	39	35	35	nw.	w.	se.	......	.45	.35
25.	29.492	29.469	29.17	29.42	29.66	46	23	29	40	38½	sw.	wnw.	e.	......	......	.07
26.	29.738	29.599	29.30	29.74	29.83	36	28	30	38½	40	nw.	calm	calm	......	......	.11
27.	29.899	29.788	29.47	29.92	29.98	42	26	33	38	37	nw.	nnw.	calm	......	......	.08
28.	30.073	29.990	29.67	30.01	30.07	44	21	34	39½	34	nw.	nw.	n.	......	......	.06
29.	30.170	30.158	29.82	30.11	30.16	39	22	28	37	37	sw.	wnw.	calm	......	......	......
☽ 30.	30.247	30.162	29.88	30.28	30.40	39	20	27.5	40	39	ne.	......	e.	......	......	.08
Mean.	29.945	29.832	29.58	29.838	29.881	43.96	27.76	34.6	40.35	40.23				0.55	1.50	4.11

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VII.—*On the* Cassidulidæ *of the Oolites, with descriptions of some new Species of that family.* By Thomas Wright, M.D. &c.*

[With two Plates.]

Since the publication of my paper † on the "Cidaridæ of the Oolites," I have collected two *Acrosaleniæ* which are quite new, and an *Echinus* of the same species as one occurring in the Corallian stage of Besançon, but very rare as a British fossil.

I now purpose describing these Cidaridæ as a supplement to that paper, before entering upon the study of the Cassidulidæ, which forms the subject of the present communication.

Acrosalenia decorata ‡, Haime.

Test hemispherical, depressed, outline subpentagonal; ambulacral areæ convex and prominent, the anterior and posterior pair slightly sinuous, having two rows of small perforated

* Read at Bredon, at the Meeting of the Cotteswold Naturalists' Club, September 10, 1851.

† Ann. and Mag. Nat. Hist. 2nd Series, vol. viii. p. 421.

‡ I had given this *Acrosalenia* another specific name, but just as my MS. was about to be sent to press, I learned that it had been described by M. Jules Haime, under the name *Milnia decorata*, either in the 'Annales des Sciences Nat.,' or in the 'Bulletin de la Soc. Géologique de France,' to neither of which works I can at present refer. I learn further that Professor Forbes has had it drawn and engraved with all the details, and will describe it in the forthcoming decade of his 'Memoirs of the Geological Survey,' under the name *A. decorata*. I have therefore withdrawn my name and the figure I had intended to give, as the multiplication of specific names is at all times to be deplored, but more especially so in our day, when a mania for the creation of species is so rife; I have therefore much pleasure in referring to the forthcoming decade of the 'Memoirs' for elaborate figures of the anatomy of the test of this beautiful species.

marginal tubercles, and the intermediate surface covered with close-set granulations; interambulacral areæ with two ranges of primary tubercles from 10–12 in a range, the four central pairs being alone fully developed; apical disc large, sur-anal plate central, anus behind encroaching on the single ovarial plate, which is rudimentary and projects far into the single area; base very concave; mouth large, in a deep depression; primary spines long, smooth, slender and tapering; secondary spines small, hair-like, numerous.

Height $\frac{4}{10}$ths of an inch, transverse diameter $\frac{8}{10}$ths of an inch.

Description.—This elegant little Urchin is remarkable among its congeners for the pentagonal outline of its test, arising from the flatness of the interambulacral and the prominence and convexity of the ambulacral areæ, and for exhibiting the bilateral symmetry of the Cidaridæ in a very interesting manner. The ambulacral areæ are about one-third the width of the interambulacral, the single ambulacrum is quite straight, and the anterior and posterior pairs are slightly sinuous; the apices of the anterior pair curve gently backwards, and those of the posterior pair upwards and inwards; two rows of small perforated tubercles alternately occupy the margins of the area, each row containing from 20–24 tubercles, which gradually diminish in size from the basal angle to the apex, the central and intermediate spaces being covered with small close-set granules; the pores are disposed in single pairs throughout the avenues.

The interambulacral areæ are three times as wide as the ambulacral, and are so much flattened that they form nearly straight lines at the circumference; the interambulacra are occupied by two ranges of primary tubercles, about eleven tubercles in each row, which are unequally developed in different regions of the area; the four ventral pairs are small and nearly of the same size; the four central pairs are fully developed, though not all of the same volume, whilst the three dorsal pairs are quite rudimentary; the areolæ of the central tubercles are transversely oblong and vertically confluent; a zigzag granular band, of four granules deep, occupies the centre of the area, separating the two ranges of tubercles from each other, and little granular bands separate the tubercles from the poriferous avenues; at the basal angle several secondary tubercles are interspersed among the granulations where the tubercles become rudimentary; at the dorsal surface the test is covered with small close-set granulations. The apical disc is large and oblong; it is formed of two anterior and two posterior pair of well-developed ovarial plates, and a single rudimentary ovarial, which extends far down the single interambulacral area, and is much encroached upon by the anal opening, which is in fact formed at the expense of the single ovarial plate.

The sur-anal plate is large and composed of several pieces, of which the largest is central; two others are posterior to it, and four or five smaller pieces form an arch at the anterior border of the anal opening which occupies nearly the whole of the single ovarial plate; the ocular plates are small and heart-shaped, and articulate with the apices of the ambulacra; the surface of the discal plates is covered with the same delicate granular sculpture which adorns the intertubercular parts of the test. The ventral surface is very concave; the mouth-opening is large, about half the diameter of the test, situated in a considerable concavity formed by the ambulacral and interambulacral areæ curving upwards and inwards towards the interior of the test; the margin is decagonal, with nearly equal-sized lobes; the teeth are carinated; the primary spines are cylindrical and tapering, and rather exceed in length the diameter of the test; their surface is sculptured with longitudinal microscopic lines; the secondary spines are small, delicate, hair-like appendages.

Affinities and differences.—*A. decorata* belongs to the group of Salenians having the anal opening situated behind the apical disc; it consequently has affinities with *A. spinosa* and *A. Wiltonii*, which it further resembles in the rudimentary condition of the single ovarial plate, and in the general structure of the ambulacral and interambulacral areæ; it is distinguished however from *A. spinosa* by having a more pentagonal outline, a more rudimentary condition of the dorsal tubercles, a more oblong and irregular-shaped apical disc, with the single ovarial plate projecting further than the others into its corresponding interambulacrum, and the sur-anal plate being formed of many elements instead of one, as in *A. spinosa*. The ventral surface is likewise more concave, the mouth-opening is proportionally larger and lodged in a deeper concavity, and the marginal lobes are more equal-sized than in *A. spinosa*. The same group of diagnostic characters will serve to distinguish *A. decorata* from its other congeners.

Locality and stratigraphical range.—This beautiful *Acrosalenia* was collected in the yellow clays of the Coralline Oolite of Wilts, and I have seen it in the ragstones of the same stage. The test is well preserved in the individual which served for our description, but the apical disc is unfortunately absent. Our description of the disc is given from another specimen.

Acrosalenia Wiltonii, Wright, n. sp. Pl. III. fig. 4 *a–e*.

Test hemispherical, sometimes depressed, sides tumid; ambulacral areæ narrow, with two rows of small marginal perforated tubercles; interambulacral areæ about three times the width of

the ambulacral, with two ranges of primary tubercles, of which the three middle pairs only attain full development; those at the base are small, and those at the dorsal surface are rudimentary; apical disc convex and prominent; sur-anal plate formed of two large and five small pieces; anal opening behind, excavated out of the single ovarial plate, which is rudimentary, the anterior and posterior pairs of ovarial plates well developed. Basal angle obtuse, from the tumidity of the sides; mouth-opening small, decagonal, with nearly equal-sized marginal lobes.

Height $\frac{11}{20}$ths of an inch, transverse diameter $\frac{11}{10}$ths.

Description.—This Urchin is almost always orbicular in the circumference, but the dorsal surface is more or less elevated in different individuals; in general it is hemispherical and depressed at the anal pole; the sides are tumid and gently rounded towards the mouth. The ambulacral areæ preserve a very uniform width through nearly all their extent. Two rows of about sixteen small perforated tubercles are arranged in alternate order on the margins of the areæ, the eight inferior pairs being larger, and the eight superior pairs gradually decreasing in size until they become quite microscopic near the apex; between the marginal tubercles a double row of granules, having a sinuous disposition, occupies the centre of the areæ. The poriferous avenues are gently undulated; on the sides the pores are placed in pairs, but at the base, from their increased numbers, they fall into triple oblique pairs. The interambulacral areæ are three times the width of the ambulacral, and furnished with two ranges of primary tubercles from 9–10 in a range; the three basal pair are small, gradually increasing however in size from the mouth-margin, where they are very small, to blend in with the three middle pairs, which attain their full development. The seventh pair are smaller than the sixth, and the eighth and ninth pairs become suddenly small and even rudimentary. The space between the tubercles is of moderate width, and is occupied by a zigzag band formed of four rows of granules, those which are arranged on the borders of the areolæ are larger and are likewise perforated; the primary tubercular ranges are separated from the poriferous avenues by a single row of small perforated granules, which form a succession of arches over the ambulacral border of the areolæ. The upper surface of the test is covered with small close-set granulations, among which the rudimentary tubercles stand conspicuous. The apical disc is rather prominent and convex, and is fortunately preserved in an otherwise imperfect specimen (Pl. III. fig. 4 *d*): but for this circumstance, we should have been in the dark touching the

natural relations of the species; it is formed of an anterior and a posterior pair of moderately-sized ovarial plates, and a rudimentary single ovarial plate. The sur-anal plate is very curious, and is composed of two unequal-sized pentagonal pieces united with the anterior and posterior ovarials, and six small pieces forming an arch which spans from the right to the left posterior pair of ovarials, and forms the anterior border of the anus; the posterior pair of ocular plates forms the lateral, and the single rudimentary ovarial plate the posterior boundary of the anal opening, which is transversely oblong, slightly excentral, and consequently placed behind the compound sur-anal plate. The ocular plates are heart-shaped and of a moderate size, and their eyeholes are very minute. The surface of the discal plates is covered with small granulations. The tumid sides are gently rounded towards the base. The mouth-opening is small, being rather more than one-third the diameter of the test; its margin is decagonal, with nearly equal-sized lobes, those of the ambulacra being the widest. The fragment of a primary spine before me is cylindrical and smooth, and judging from its thickness must have been long. The secondary spines are short, prickle-shaped, and sculptured with fine longitudinal lines (4 *e*).

Affinities and differences.—The preservation of the apical disc proves that the natural affinity of this species is with *A. spinosa* and *A. decorata*, whilst in the general form and structure of the test, *A. Wiltonii* most resembles *A. hemicidaroides*; but it differs from that species in having the anal opening behind the sur-anal plate, whereas in *A. hemicidaroides* it is situated before it.

Locality and stratigraphical range.—This *Acrosalenia* was collected from the Cornbrash near Sutton Benger, Wilts; it appears to be rare. I dedicate this species to my friend John Wilton, Esq., of Gloucester.

Echinus gyratus, Agassiz.

Syn. *Echinus gyratus*, Echin. Foss. de la Suisse, part 2. p. 87. tab. 23. fig. 43–46.

Echinus petallatus, M'Coy, Annals Nat. Hist. vol. ii. p. 409, 2nd Series.

Test hemispherical, more or less elevated, with an orbicular circumference, divided into fifteen slightly convex lobes; ambulacral areæ half the width of the interambulacral, with two complete rows of marginal tubercles extending from the mouth to the apical disc, and two incomplete rows of central tubercles occupying about two-thirds of the sides thereof; interambulacral areæ with a smooth concave median space extending from the disc to near the basal angle; each of the two lobes formed thereby has one complete central range of

tubercles, and two lateral incomplete ranges of tubercles; at the circumference of the test there are twelve rows of tubercles; apical disc well developed; anal opening central; base flat; mouth-opening large, almost pentagonal from the length of the arches over the ambulacra; spines unknown.

Height $\frac{19}{20}$ths of an inch, transverse diameter 1 inch and $\frac{9}{20}$ths.

Description.—The distinguishing characters of this beautiful Urchin are so prominent, that it forms a well-marked species of a genus, in which in general specific distinctions are far from being clearly defined. The test is hemispherical and elevated at the vertex, and is very regularly formed; its surface is divided into fifteen nearly equal-sized lobes grouped into five divisions of three lobes each, of which the ambulacrum forms the centre lobe, and the half of the adjoining interambulacra the lateral lobes. The distinctive character of the test consists in the median concave depression in the centre of the interambulacra which extends from near the circumference to the apex, and is entirely destitute of tubercles and granules; near the circumference however small tubercles occupy the space, and at this point we observe twelve tubercles in a row in the interambulacra. Each area is thus divided into two convex lobes; in each lobe one complete range of tubercles extends from the mouth to the vertex, and two incomplete rows occupy each side thereof; at the widest part of the area only a few additional tubercles are introduced. The ambulacra are about one half the width of the interambulacra, and are furnished with two complete rows of marginal tubercles, and two incomplete rows which occupy the central parts of the sides; around the circumference of the tubercles, forming the complete ranges, a series of small granules are disposed in circles, and similar moniliform granular rings surround the larger tubercles of the incomplete rows. The tubercles of both areas are large and prominent, and their surfaces are highly polished; those of the base are larger than those of the sides; and, as a general remark, it may be stated that the test is uniformly very granular.

The pores are disposed in rather wide avenues in triple oblique pairs, among which, some of the small granules encircling the marginal tubercles of the ambulacra are scattered. The apical disc is large and central; the anterior pair of ovarial plates are the smallest, the posterior pair are larger, and the single madreporiform plate is the largest of the disc; the ocular plates are small and pentagonal, and stand distinctly out from the angles of the ovarials; the eyeholes are small and central; the anal opening is large and transversely oblong; the surface of the ovarial and ocular plates is covered with small granules,

and the spongy madreporiform body is prominent and convex. The mouth-opening is very large, and has more the appearance of being pentagonal than decagonal, from the extreme shortness of the arches over the termination of the interambulacral, and the disproportionate span of those over the ambulacral areas.

Affinities and differences.—This *Echinus* resembles some granular varieties of *E. perlatus,* and the concave median space in the interambulacra of that species increases the resemblance thereto; but the following structural differences afford good diagnostic characters by which the two forms may always be distinguished from each other. In *E. gyratus* the naked concave median space in the interambulacra is wider, and extends much further down the sides than the corresponding space in *E. perlatus.* The ambulacral areæ have four rows of tubercles in *E. gyratus,* and only two rows in *E. perlatus.* The lateral tubercles in the secondary ranges of the interambulacral areæ are nearly as large as those of the complete ranges of the same in *E. gyratus,* whereas the secondary ranges of the corresponding areæ in *E. perlatus* are smaller and even sometimes rudimentary. The tubercles themselves in *E. gyratus* are more prominent and convex, and are more highly polished than those of *E. perlatus.* The same group of characters enables us to distinguish this species from its other congeners. Prof. M'Coy has described an *Echinus* from the Coralline Oolite of Wilts under the name *E. petallatus,* which we consider to be identical with *E. gyratus*: we cannot admit that an increased elevation of the test, or a greater extent of the naked surface of the plates, are sufficient characters to justify the separation of species: our specimen was obtained from the same stage and locality, and as we are not acquainted with any other *Echinus* for which it could be mistaken, we have no doubt of its identity with the *E. petallatus.*

Locality and stratigraphical range.—This Urchin was collected from the clay beds of the Coralline Oolite of Wilts; at present we are not aware of its having been found in any other locality in this country. Its foreign distribution is likewise limited to the "Terrain à chailles" or Corallian stage of Besançon.

History.—First described by M. Agassiz in his 'Echinodermes Fossiles de la Suisse,' where it is beautifully and faithfully figured; afterwards noticed by Prof. M'Coy under the name *E. petallatus,* from the Coralline Oolite of Wilts. We are inclined to think that this Urchin is the same which was figured by Parkinson in the 3rd vol. of his 'Organic Remains,' and described as an "Echinite from France."

On the Cassidulidæ.

The Cassidulidæ have been recently dismembered by Agassiz and Desor from the family Clypeastroidæ, in consequence of the mouth of the Cassidulidæ being destitute of the jaws and teeth possessed by the true Clypeastroidæ*: how far this supposed negative edentulous character is of sufficient zoological importance to justify the separation of the Cassidulidæ from the great natural family which they resemble in most of the important points of their structure, it is not our intention on the present occasion to inquire; it has however the palæontological merit of grouping together many genera of Echinida closely related to each other by structural affinities as well as by their limited distribution in time.

Family Cassidulidæ.

Urchins having an oblong, subpentagonal or orbicular circumference, generally clypeiform, with a uniform convex dorsal surface, mostly depressed, but sometimes elevated or conoidal; the shell is of moderate thickness, and its surface is covered with small tubercles and granules. The tubercles are smaller on the dorsal than on the ventral surface, and are surrounded by a circular depression; sometimes the tubercles are arranged in vertical ranges, but in general they are sporadical. The granules are entirely microscopic, and occupy the intertubercular spaces; to the whole of the tubercles small filiform spines are attached. The ambulacral areæ are narrow, and the pores are disposed in close-set pairs, forming a single file as in the *Galerites*; or they are placed at some distance apart, and united by transverse sutures, which occasions the petaloid forms seen on the dorsal surface of the test of the *Nucleolites*.

The mouth is central or subcentral, and is sometimes armed with jaws and teeth; in some genera its margin is divided into ten lobes; in others it is edentulous and the opening is round or pentagonal, and sometimes surrounded by five prominent lobes, formed by the folding inwards of the terminal portions of the interambulacra. The anal opening is large, and situated on the dorsal or ventral surface; it is rarely marginal, often infra-marginal, and when dorsal is lodged in a valley. The apical disc is formed of four perforated ovarial plates and a single imperforate

* This generalization is not strictly in accordance with the facts. The existence of a dental apparatus was discovered by Mr. Chas. Stokes in *Galerites albogalerus*, and specimens of this cretaceous Urchin, with the lantern and teeth, are in the cabinets of Messrs. Stokes and Bowerbank. It is probable that all the members of the Galerite group with a central decagonal mouth-opening possessed a similar dental armature.

ovarial; the madreporiform body is generally situated in the centre, around which the ovarials are arranged; the five ocular plates are small, and lodged at the apices of the ambulacra. From the structure of the ambulacra we divide the Cassidulidæ into two groups.

1st Group of Echinoneides*.

Ambulacra simple, uniform throughout; mouth circular, decagonal or pentagonal, without prominent lobes.

Genus Pygaster, Agassiz.

Test subpentagonal, more or less depressed; surface of the plates covered with small perforated tubercles, raised on mammillated and crenulated eminences, disposed in regular vertical rows, and surrounded by areolæ with encircling granules; the tubercles attain their greatest development at the circumference and base of the test; ambulacral areæ with four or six rows of tubercles; interambulacral areæ with from 12–20 rows; mouth-opening central and circular, margin divided into ten equal lobes, the notches of which correspond to the sutural junction of the ambulacra with the interambulacra; anal opening very large, occupying the upper half of the single interambulacral area; pores arranged in simple pairs throughout the avenues; apical disc unknown. This genus is extinct; the species are distributed throughout the Oolitic and Cretaceous rocks.

Pygaster semisulcatus? Phillips.

Syn. *Galerites umbrella*?, Lam. Anim. sans Vert. t. iii. p. 25.
Nucleolites umbrella, Defrance, Dict. Sc. Nat. t. xviii. p. 87.
Clypeus semisulcatus, Phillips, Geol. of York. part 1. pl. 3. fig. 17.
Clypeus ornatus, Buck. Murchison's Geol. of Cheltenham, 2nd ed. p. 95.

Test subpentagonal, depressed; interambulacra with from 16–18 rows of tubercles at the circumference; ambulacra prominent and convex, with four rows of tubercles; anus very large, occupying nearly the upper half of the single interambulacrum; mouth deeply notched; spines short, subulate, and longitudinally striated.

Height 1 inch and $\frac{5}{10}$ths, antero-posterior diameter 3 inches, transverse diameter 3 inches.

Description.—The imperfect condition of the test of *Pygaster*

* The group of Echinoneides comprehends eleven genera: *Echinoneus*, Van Phels; *Pygaster*, Agass.; *Holectypus*, Desor; *Discoidea*, Gray; *Galerites*, Lam.; *Pyrina*, Desml.; *Globator*, Agass.; *Caratomus*, Agass.; *Nucleopygus*, Agass.; *Hyboclypus*, Agass.; *Dysaster*, Agass.

umbrella figured by Agassiz, does not enable us satisfactorily to compare that Urchin with our specimen, and leaves a doubt upon our mind whether the Urchin known to Lamarck was identical with this species. We have examples corresponding in form, size, and comparative dimensions with Agassiz's figure, but the absence of the sculpture of the plates in the Swiss specimen leaves the question in doubt : through the kindness of Professor Forbes we have compared our Urchins with the one sent by Mr. Phillips from Yorkshire, and have proved their identity; but having had no opportunity of examining typical foreign specimens, we have provisionally adopted Mr. Phillips's specific name. The ambulacra are one-fourth part the width of the interambulacra; they are prominent and convex, and furnished with four rows of tubercles, the marginal rows extending from the mouth to the apical disc, whilst the internal rows disappear near the mouth and about half-way up the dorsal surface; the interambulacra at the circumference have from 18–20 rows of tubercles; the number however gradually diminishes between the basal angle and the mouth, and the circumference and the apical disc, so that from two to four rows only extend from the mouth to the vertex. The mammillated eminences on which the tubercles are placed are encircled by smooth areolæ, surrounded by small granules arranged round their circumference, which gives the intertubercular surface of the plates a granular structure. The tubercles are small, prominent and perforated, and the summits of the mammæ are crenulated as in the Cidaridæ. These characters added to others, as the regularity of the arrangement of the tubercles, and the dorsal position of the anal opening, lead us to consider *Pygaster* as a transition form connecting the Cidaridæ with the Cassidulidæ. The base is concave, and the mouth is central and situated in a considerable depression; the opening is about one-fifth the diameter of the test at the circumference; its margin is divided into ten nearly equal-sized lobes, the angles of which correspond to the divisional sutural lines between the ambulacra and the interambulacra. The anus is a large oval opening in the upper half of the single interambulacrum, forming a great gap in this part of the test, and constituting one of the most important characters of the genus. In the living animal this space was probably occupied by a membrane, but in the fossil condition it has the appearance of the test having been fractured and lost. The apical disc is absent in all the specimens of *Pygaster* that have passed through our hands. The pores are set closely together in pairs throughout the entire range of the avenues; sometimes they have a slightly oblique disposition. The spines adhering to the fine specimen before me are short, needle-shaped, and delicately striated longitudinally.

Affinities and differences.—P. semisulcatus most nearly resembles *P. umbrella*; we have before us specimens which are well represented by Agassiz's figure; but the loss of the tubercles from the Swiss specimen leaves the question of their identity an open one, as we regard the special form of sculpture of the test a most important specific character. *P. semisulcatus* differs from *P. Morrisii* in having narrower ambulacra and fewer tubercles on both areæ; the size and number of the tubercles and the depression of the test afford distinguishing characters between it and *P. conoideus*.

Locality and stratigraphical range.—This Urchin is abundant in the lower ferruginous beds, "the Pea-grit" of the Inferior Oolite at Crickley, Birdlip, and Leckhampton Hills, and in the shelly freestone of the same localities, and I have collected small specimens from the planking beds of the Great Oolite at Minchinhampton; in Yorkshire it was collected by Mr. Phillips * from the Coralline Oolite of Malton and Scarborough. In the Pea-grit it is associated with *Diadema depressum, Hyboclypus agariciformis, Rhynconella Wrightii, Thecidea triangularis, Terebratula simplex*, and *Ter. plicata*.

History.—This species was figured by Mr. Phillips, but not described, in his 'Geology of Yorkshire.' The absence of typical foreign specimens does not enable us to decide whether the *Galerites umbrella* of Lamarck is identical with Mr. Phillips's species. The fine and nearly perfect specimen before me has been figured by Professor Forbes for the 4th Decade of his admirable 'Illustrations of British Fossils;' for this reason we have not given a drawing of the species.

Pygaster conoideus, Wright, n. sp. Pl. III. fig. 1 *a–d*.

Test conoidal, with a pentagonal circumference; ambulacra narrow and prominent, with two rows of marginal tubercles and two imperfect rows of central tubercles; interambulacra four times the width of the ambulacra, with very small tubercles and a scanty granulation on the surface of the plates; anal opening comparatively small, occupying the upper third of the single interambulacrum; base flat.

Height 1 inch and $\frac{3}{10}$ths, antero-posterior diameter 2 inches and $\frac{9}{20}$ths, transverse diameter 2 inches and $\frac{4}{10}$ths.

Description.—This Urchin is remarkable for its conoidal form, the anterior and lateral walls of the test forming angles of from 50° to 55° with the base, and the posterior wall an angle of about 42° (fig. 1 *b*). The ambulacra are narrow and prominent, having

* Geol. of Yorkshire, Part 1. p. 127.

two complete rows of tubercles arranged on the sides of the areæ (fig. 1 *c*), and two incomplete rows of tubercles internal to them, which are neither so regular in their arrangement as the marginal rows, nor do they extend beyond the lower half of the areæ; the single ambulacrum is perpendicular; the anterior pair arch gently upwards and backwards, whilst the posterior pair rise forwards and upwards for three parts of their course, and then make a short curve round the anal opening, and terminate at the lateral border thereof. The pairs of pores are disposed very closely together in well-defined narrow avenues, which form distinct boundaries between the ambulacra and the interambulacra; at the basal angle the interambulacral are four times the width of the ambulacral areæ; the plates (fig. 1 *d*) are adorned with rather irregular rows of very small tubercles varying in number from four to sixteen in a row in different parts of the area; the smooth areolæ around the tubercles are very superficial; their circumference is encircled by rows of microscopic granules: besides these granular circles, there is scarcely any other sculpture on the plates, which gives a great smoothness to the test of *P. conoideus* when compared with that of *P. semisulcatus.* The anal opening (fig. 1 *a*) when compared with that of the latter is proportionally small, occupying rather more than the upper third of the single interambulacrum; the portion of the area below the vent is flattened and slightly concave. The base is covered with the oolitic matrix, which here forms a hard crystalline rock, and cannot be removed without fracturing the test; enough is exposed however to show that the base is slightly concave, and that the tubercles are much better developed in this region than on the dorsal surface. The apical disc is absent, and we know nothing of the spines.

Affinities and differences.—This Urchin resembles *P. semisulcatus* in its pentagonal form and in the number of the tubercles on the areæ; but is distinguished from that common species by the greater prominence of the ambulacra, the smallness of the tubercles, the superficiality of the areolæ, the microscopic character of the granulations, the elevated conoidal form of the test, and the smallness of the anal opening; it is a rare species, the specimen which we figure being the only one we have ever met with in our researches; a second specimen is in the cabinet of our friend John Lycett, Esq.

Locality and stratigraphical range.—I found this Urchin in the Pea-grit of Crickley Hill. Mr. Lycett's specimen came from the Inferior Oolite near Stroud.

Pygaster Morrisii, Wright, n. sp. Pl. IV. fig. 1 *a–d.*

Test much depressed and pentagonal, basal angle tumid; ambulacra wide, prominent and convex, with six rows of tubercles;

interambulacra with from 20 to 22 rows of tubercles at the circumference; base flat, depressed towards the centre; the single interambulacrum truncated posteriorly; anal opening large, occupying three-fourths of its upper surface.

Height $\frac{8}{10}$ths of an inch, antero-posterior diameter 2 inches and $\frac{3}{20}$ths, transverse diameter 2 inches and $\frac{5}{20}$ths.

Description.—The ambulacral areæ of this Urchin are wide, convex, and prominent, and form an exception to Agassiz's generalization, that in the genus *Pygaster* the ambulacra are furnished with only four rows of tubercles, for in this species there are six well-developed rows at the circumference of the test (fig. 1 *c*); the two marginal rows extend from the mouth to the vertex, the two middle rows commence at a short distance from the mouth and terminate at a short distance from the vertex, and the two internal rows commence about four lines above and extend about the same distance beyond the basal angle. The interambulacral areæ are three times the width of the ambulacral, and are furnished with twenty-two rows of tubercles at the circumference of the test; they attain their greatest development at the base of the areæ, and are arranged so uniformly, and disposed so closely together, that they present somewhat the appearance of a mosaic work (fig. 1 *d*); the areolæ are deeply sculptured out of the plates, and surrounded by circles of very small granules; of the twenty-two rows of tubercles which occupy the area at the circumference, only six, and those the three central rows of each column, extend from the mouth to the vertex, the others are limited to shorter distances, the length of their range being in proportion to their distance from the margin of the columns. The poriferous avenues are narrow, and the pores are small and set closely together in pairs. The basal angle is tumid (fig. 1 *b*); the base is flat and depressed towards the centre; in this depression the mouth is situated; the opening is small, being only one-sixth the diameter of the test at the circumference. The anus is a large oblong opening (fig. 1 *a*), occupying at least the upper three-fourths of the single interambulacrum. The apical disc is absent; the spines are short, needle-shaped, and finely striated longitudinally. The test is very thick.

Affinities and differences.—This species resembles *P. laganoides*, Agassiz, in its depressed form, obtuse basal angle, and truncated single interambulacrum; but *P. Morrisii* is distinguished from *P. laganoides* in possessing a greater number of tubercles in both areæ, *P. laganoides* having four rows in the ambulacral and twelve in the interambulacral, whilst in *P. Morrisii* the corresponding areæ possess six and twenty-two. We know no other species among its congeners for which it could be mistaken.

Locality and stratigraphical range.—This rare species was collected from the Cornbrash at Stanton, Wilts, and is the only specimen we know from that stratum. We have seen a *Pygaster* from the Great Oolite near Cirencester, which apparently belongs to our species; it was a crushed specimen, but the number of the tubercles on the areæ was the same as in our species.

Genus Holectypus, Desor.

Test circular, more or less hemispherical, conical or subconical, always tumid; mouth central and decagonal; anal opening large, inferior, infra-marginal, rarely marginal, sometimes occupying the entire space between the mouth and the border; ambulacra simple, continuous and radiant; avenues with a single pair of pores throughout; tubercles small, perforated and crenulated, disposed in a regular series; apical disc central and vertical, composed of four perforated and a single imperforated ovarial plate, a central madreporiform body, and five ocular plates; the internal walls of the test *without* projecting ribs.

The genus *Holectypus* was formed by M. Desor for those *Discoideæ* which have no projecting processes or ribs on the inner wall of their test. The species of which the group is composed are found in the oolitic and lower cretaceous rocks. They constitute a transition from the *Discoideæ* to the typical *Galerites*, and according to the views of Professor Forbes "form a section or subgenus of the genus *Galerites*, more valuable on account of their palæontological merits and limited distribution in time (being the main characteristic of the Oolitic period) than for the zoological importance of the characters of their organization, which are rather transitional than distinctive."

Holectypus depressus, Desor.

Syn. *Galerites depressus*, Lamk. Animaux sans Vert. tome iii. p. 21. no. 7; Desmoulins, Table Synopt. p. 254; Goldfuss, Petrefact. Ger. tab. 41. p. 129; Koch and Dunker, N. D. Oolit. tab. 4. fig. 2.

Discoidea depressa, Agassiz, Cat. Syst. p. 7; Echin. Foss. de la Suisse, tab. 13 bis, fig. 7–13.

Holectypus depressus, Desor, Catal. raisonné des Echinides, A. S. N. tom. vii. 3rd Series.

Test hemispherical, more or less depressed, sometimes conical; circumference circular or subpentagonal; base concave; tubercles small on the dorsal surface, larger on the base; anal opening pyriform, infra-marginal; apex directed towards the mouth.

Height $\frac{7}{10}$ths of an inch, antero-posterior diameter 1 inch and

$\frac{4}{10}$ths, transverse diameter 1 inch and $\frac{4}{10}$ths (Inferior Oolite specimens). Height $\frac{8}{10}$ths of an inch, antero-posterior diameter 1 inch and $\frac{8}{10}$ths, transverse diameter 1 inch and $\frac{7}{10}$ths (Cornbrash specimens).

Description.—The inconsiderable prominence of the ambulacra of this Urchin gives the circumference a subcircular outline; the areæ are furnished with from six to eight rows of tubercles, four of which only extend from the mouth to the vertex; the other rows disappear at various distances from the circumference, where they are most fully developed. The interambulacra are twice and a half the width of the ambulacra, and furnished at the circumference with sixteen rows of tubercles, a few of which only form distinct horizontal ranges on the dorsal surface of the test; the perforated tubercles are encircled with fine granulations which cover likewise the intertubercular surface of the plates; the base is concave, and the tubercles of both areæ attain their greatest development in this region, presenting in their size a remarkable contrast to the microscopic character of those occupying the upper surface of the test.

The apical disc is central, and occupies the vertex; it is composed of four perforated ovarial plates, and a single imperforate plate with five ocular plates; the madreporiform body is largely developed and projects from the single imperforate ovarial towards the centre of the disc, where the line of suture between the other plates is not clearly defined; the madreporiform body has the appearance of a central spongy mass, round which the ovarial and ocular plates are disposed, and has been figured and described as such by Agassiz and Desor; but specimens before me, from the Inferior Oolite of Dundry and the Cornbrash of Wilts, prove this to be an error. The single ovarial plate, with its madreporiform body, is of an irregular pentagonal form, the spongy portion projecting inwards to the centre; the anterior and posterior pair of ovarial plates are of a pentagonal form, and are perforated at their apices for the passage of ducts; the ocular plates are likewise pentagonal and wedged between the ovarial plates at the summits of the ambulacra, where the eyeholes are situated. The mouth occupies the centre of the concave base, but is rather nearer the anterior than the posterior border; it is about one-third the diameter of the test, and its margin is divided into ten lobes. The anal opening is large, occupying nearly all the basal portion of the single interambulacrum; it is of a pyriform shape, having the apex directed towards the mouth, and the round base towards the border of the test. The poriferous avenues are occupied by a row of pores placed in pairs, and extending without interruption from the margin of the mouth to the apical disc. The spines are unknown.

Affinities and differences.—This species resembles *H. hemi-*

sphæricus in its general outline, but is well distinguished from it by the position of the anal opening. In *H. depressus* the anus is infra-marginal with the apex directed inwards, whilst in *H. hemisphæricus* that opening is marginal with the apex directed outwards. The specimens from the Inferior Oolite are in general smaller and more tumid than those obtained from the Cornbrash, which have a much greater diameter, but are proportionally more depressed and have a more acute basal angle.

Locality and stratigraphical range.—I have collected this Urchin from the upper beds of the Inferior Oolite along the entire range of the Cotteswolds. Dundry, Wootton-under-Edge, Stinchcombe, Rodborough, Coopers, Birdlip, Shurdington, Leckhampton and Winchcombe Hills may be named as good localities in Gloucestershire. I have obtained the large specimens from the Cornbrash near Kemble Tunnel, Great Western Railway, and from Stanton, Wilts, and near Woodstock, Oxon. Mr. Phillips has found it in the Cornbrash of Yorkshire. The foreign localities are, "the corallian stage of Liesberg, environs of Bamberg, Muttenz, Metz, the Oxfordian stage of Vivoin and Chauffour (Sarthe), d'Alençon, Boulogne, Mamers, Châtillon-sur-Seine and Latrecy (Haute Marne) *." Goldfuss assigns as its localities the upper and middle beds of the Jurakalk in Bavaria and Würtemberg †. Koch and Dunker have found it in the sandy dolomitic limestone of Tönnjesberges in Hanover ‡.

History.—*Holectypus depressus* has been long known to palæontologists, being very generally found in the lower and middle divisions of the Jurassic strata throughout Europe; it is figured in the works of Goldfuss, Koch and Dunker, and Agassiz: the figures of the latter author are the most correct and abundant in details.

Holectypus hemisphæricus, Desor.

Syn. *Discoidea hemisphærica*, Agassiz, Cat. Syst. p. 7; Desor, Monogr. des Galerites, p. 71. pl. 8. fig. 4–7.

Holectypus hemisphæricus, Agass. and Desor, Cat. raisonné des Echinides, A. S. N. vol. vii. p. 146, 3rd Series.

Galerites hemisphæricus, Forbes, Memoirs of the Geol. Survey, Decade 3. pl. 6.

Var. *a. Depressus.*—*Discoidea marginalis*, M'Coy, Ann. Nat. Hist. vol. ii. p. 413, 2nd Series.

Var. *b. Conicus, anus valde marginalis.*—*Holectypus Devauxianus*, Cotteau, Etudes sur les Echinides fossiles, p. 46. pl. 2. fig. 7–9.

Test tumid, hemispherical, more or less depressed; margin rounded; tubercles larger on the ventral than on the dorsal surface, and increased in size around the mouth; single interambulacrum

* Ann. des Sc. nat. tome vii. p. 145, 3rd Series.

† Petrefact. Germaniæ, Part I. p. 130. tab. 41.

‡ N. D. Oolith. Versteinerungen, p. 40. tab. 4. fig. 2.

slightly produced; anal opening pyriform, with the apex directed outwards and upwards, excavated out of the base and border of the single area; base concave; mouth small, nearly central, situated in a depression.

Height $\frac{6}{10}$ths of an inch, antero-posterior diameter 1 inch and $\frac{2}{10}$ths, transverse diameter 1 inch and $\frac{1}{10}$th.

Description.—This Urchin resembles the preceding species in its general outline, but a careful inspection shows that it differs in many important particulars from it. The test is sub-hemispherical, more or less depressed in different individuals; the antero-posterior exceeds the transverse diameter, and the apical disc and the vertex are excentrical, being situated nearer the anterior than the posterior border, thereby occasioning a slight obliquity, which is more or less evident in different individuals; the sides are tumid, and the border is gently rounded. The base is concave and much depressed in the centre, in which concavity the mouth-opening is situated; it is nearer the anterior than the posterior border, and is less than one-third the transverse diameter of the test, its margin being divided into ten nearly equal lobes. The ambulacral areæ taper very gradually; each pair of the small narrow plates supports a tubercle, which occupies the same relative position thereon on every fourth plate, so that the areæ are adorned with six rows of tubercles arranged obliquely in V-shaped lines. The pores form pairs set closely together in single files throughout the avenues; about the middle of the sides there are from four to five pairs of pores opposite each interambulacral plate. The interambulacral areæ are twice and a half the width of the ambulacral; in the specimen before me there are twenty-seven plates in each column; each of the side plates is slightly bent upwards in the middle, whilst those of the base are nearly straight; each plate carries from four to eight tubercles surrounded by circles of minute granules. The tubercles are arranged on the plates in such a manner that they form curved lines on the areæ; they are more closely crowded together at the basal angle, and are fewer in number, but of larger size, around the mouth, where they are set more widely apart; each tubercle is perforated and raised upon a mammillated eminence with a crenulated summit: even the encircling granules exhibit perforations when viewed with a high magnifying lens. The spines are unknown. The apical disc is small, and formed of five ovarial and five ocular plates; the anterior pair of ovarials are the largest, and the right*, which is the

* The Urchin is supposed to be placed *before* the observer, with the anterior border before, the anal border behind; the right and left sides of the test consequently correspond to his.

widest, has attached to its surface a spongy prominent body; the posterior pair are smaller, and both pairs are perforated; the single ovarial is the smallest and is imperforate; the ocular plates are small pentagonal bodies, wedged between the angles formed by the ovarials; they are placed opposite the summits of the ambulacra, and have the eyeholes pierced at their lowest border. The anus is a large opening situated in the margin of the single interambulacrum; it is of a pyriform shape, having the base directed towards the mouth, and the apex extending some distance, about one-fourth part up the side; the proportional size of the opening varies in the suite of specimens before me; in all, however, it is constantly marginal.

Affinities and differences.—This species nearly resembles *H. depressus* in its hemispherical form and general outline; it is readily distinguished from it however in being a little more elongated, in having the anal opening marginal and the vertex and apical disc slightly excentrical, but the marginality of the anus is the most important diagnostic character.

Locality and stratigraphical range.—This species was collected at Shurdington Hill with *H. depressus*, where it is rare; it was collected in abundance by Messrs. Bristow and Gapper* along with *Dysaster ringens* and *D. bicordatus* from the sands of the Inferior Oolite in Dorset and Somerset. M. Desor† found it in Normandy in a particular bed of the Calcaire au Polypiers known by the name of Caillasse, and M. Cotteau‡ obtained it from the Inferior Oolite of Tour-du-Prè, associated with *Dysaster ringens* and *Diadema depressum.*

History.—First figured and described by M. Desor in his 'Monograph des Galérites,' and lately exquisitely figured in detail and admirably described by Prof. Forbes in the 3rd Decade of his 'Palæontological Memoirs of the Geological Survey.'

Genus Hyboclypus, Agassiz.

Urchins having a circular, oblong, or subpentagonal circumference, with the dorsal surface in general much depressed. The ambulacral areæ meet above at two points as in the genus *Dysaster*; the single and anterior pair of ambulacra terminate at the anterior border of the apical disc, the posterior pair at a short distance from them. The anus is situated in a deep valley extending from the vertex to the posterior border of the test. The base is much undulated; the mouth is excentrical, placed nearer the anterior border; it is of a pentagonal form and has no marginal folds. The surface of the test is covered with small close-

* Memoirs of Geol. Survey, Decade iii.

† Monogr. des Galérites, p. 71.

‡ Etudes des Echinides Fossiles, p. 46.

set perforated tubercles, raised on eminences with crenulated summits; the pores are disposed in pairs in a single file. This form is at present known only in a fossil state, and appertains to the Oolitic period.

Hyboclypus agariciformis, Forbes, n. sp.

Test disciform, subpentagonal, and much depressed; ambulacra narrow, the three anterior straight, the posterior pair sinuous; interambulacra unequal and covered with an immense profusion of microscopic tubercles; apical disc central and vertical; anal valley deep with parallel sides, which gradually expand about the middle of the single interambulacrum; mouth-opening small.

Height $\frac{9}{10}$ths of an inch, antero-posterior and transverse diameters 3 inches and $\frac{1}{10}$th. One large specimen measures, in the antero-posterior and transverse diameters, 3 inches and $\frac{6}{10}$ths.

Description.—The outline of this Urchin varies a little in different individuals; in general the antero-posterior equals the transverse diameter, but sometimes the transverse exceeds the antero-posterior diameter. The ambulacra are of unequal width; the single anterior area is the narrowest, and the posterior pair are the widest; each pair of ambulacral plates carry from four to six tubercles, which are so disposed that they form oblique rows of from four to six in a row, which meet in the median line and branch upwards and outwards, forming thereby V-shaped figures. The pores are arranged closely together in pairs on the dorsal surface, but from the basal angle to the mouth they are set wider apart, and fall into triple oblique pairs. The interambulacral areæ are of unequal width; the anterior pair measure at the circumference 1 inch and $\frac{3}{10}$ths, the posterior pair 1 inch and $\frac{11}{20}$ths; the single area is $\frac{1}{10}$th of an inch wider than the posterior pair. The inequality in the width of these areæ causes the subpentagonal form of the test; the interambulacral plates are slightly bent upwards at the middle, and their surface is covered with numerous small tubercles; in an ordinary-sized plate, I have counted 100 tubercles, each of which is perforated and surrounded by an areola. The base is flat and slightly undulated, in consequence of the ambulacra forming straight valleys, and the interambulacra convex conical lobes between the basal angle and the mouth. The oral opening is situated nearer the anterior than the posterior border; it is small, of a pentagonal form, and has the border surrounded by five small lobes formed by the termination of the interambulacral areæ; the tubercles are large and more fully developed on the basal than on the dorsal surface of the test, and the areolæ are seen in this region

to be merely the margins of the depressions in the centre of which the tubercles are placed. The apical disc is situated in the vertex and is nearly central; the plates of which it was formed are absent in all the specimens I have seen; the single and the anterior pair of ambulacra converge around its anterior border, and the posterior pair terminate about two lines from the latter at the posterior and external side of the disc. The single interambulacrum is somewhat wider and longer than the others; the anal opening is situated in its dorsal part in a deep valley with parallel vertical sides covered with tubercles; about the middle of the opening, the valley expands and forms a concave depression in its lower half; the basal portion of the area is slightly produced, and forms a lip-shaped process, which gives a considerable convexity and prominence to the basal angle of this area.

Affinities and differences.—*H. agariciformis* differs so widely from its congeners in our Oolites that it cannot be mistaken for either of them; its shield-shape and depressed vertex distinguish it from *H. gibberulus,* and its dimensions, circular form, and rounded posterior border serve as diagnostic characters between it and *H. caudatus.* From *Pygaster,* with which form it has been erroneously grouped, it is distinguished by the greater number and microscopic character of the tubercles in *Hyboclypus,* the deep anal valley with its parallel vertical walls, and the excentric five-lobed mouth; whereas in *Pygaster* the tubercles are fewer and larger, the anal opening forms a large space without a valley and parallel walls, and the mouth is central, and has its margin divided into ten lobes like *Holectypus* and all the Cidaridæ.

Locality and stratigraphical range.—This species is tolerably abundant in the lower ferruginous beds, "the Pea-grit" of Leckhampton, Crickley, Birdlip, Coopers, and Cleeve Hills: as far as we at present know, it is not found in the middle division of the Oolites.

History.—This species has been elaborately figured for the 4th decade of Professor Forbes's 'Memoirs of the Geological Survey' from the specimens now before me, and will be described in detail in that work, to which I beg to refer for more ample particulars.

Hyboclypus caudatus, Wright, n. sp. Pl. III. fig. 2 *a–e.*

Test oblong, much depressed; single interambulacrum produced into a caudal prolongation; mouth very excentric, near the anterior border; apical disc and vertex slightly excentric, anterior border blunt, posterior border truncated.

Height $\frac{9}{20}$ths of an inch, antero-posterior diameter 1 inch and

$\frac{9}{10}$ths, transverse diameter 1 inch and $\frac{1}{10}$th. The great majority of the specimens average as follows :—

Height $\frac{7}{20}$ths of an inch, antero-posterior diameter $\frac{15}{20}$ths of an inch, transverse diameter $\frac{13}{20}$ths of an inch.

Description.—The test of this elegant little species is covered with tubercles so minute, that without the assistance of a good lens, the observer might suppose that it was altogether destitute of sculpture; the single and anterior pair of ambulacra are straight and very short in consequence of the excentricity of the mouth and vertex, and terminate at the anterior border of the apical disc; the posterior pair are one-seventh longer, and curve upwards, inwards, and forwards on the dorsal surface, terminating by the anal valley at a short distance from the posterior border of the disc. The pores are placed closely together on the dorsal surface, but are situated at wider distances apart at the base.

The interambulacra are of unequal width; the anterior pair are the shortest and narrowest, the posterior pair the widest, and the single area the longest, which is likewise considerably produced into a lip-like process, which curves gently downwards and is abruptly truncated posteriorly. The anal furrow is deep with vertical parallel walls, which gradually expand into two ridges, corresponding with the truncated borders of the lip-like process. The anterior border is blunt, with a slight depression in the middle formed by the single area; the base is concave and slightly undulated; the mouth is situated near the anterior border, and is a simple pentagonal opening without lobes; the tubercles in this region are somewhat larger, but they are fewer in number and arranged with much irregularity on the plates. The apical disc is unfortunately broken in all the specimens we have examined; the space which it occupied is however very small.

Affinities and differences.—*H. caudatus* differs from its congeners by its oblong form, posterior lip-like process formed by the single interambulacral area and its depressed and excentrical vertex; it is distinguished from *H. gibberulus* by the absence of the anterior central ridge characterizing that species, and from *H. agariciformis* it is distinctly separated by its oblong form and excentric mouth and anus.

Locality and stratigraphical range.—This is not a common Urchin; it is found occasionally in the lower and upper beds of the Inferior Oolite at Leckhampton, Crickley, and Birdlip Hills, and it occurs occasionally in the planking beds of the Great Oolite at Minchinhampton. The specimens from the latter locality are in general small and not well preserved; the individual which we figure is the largest we have seen.

Hyboclypus gibberulus, Agass.

Syn. *Hyboclypus gibberulus*, Agassiz, Echinoderm. Foss. de la Suisse, Part 1. p. 75. pl. 13. fig. 10–12; Desor, Monograph des Galérites, p. 84. pl. 13. fig. 12–14.

Test nearly orbicular, elevated and contracted anteriorly, enlarged, depressed, produced and truncated posteriorly; the single ambulacral area the highest, and forming a gibbous crest by an elevation of the anterior pair of interambulacral areæ; anal valley wide and deep; single interambulacrum slightly produced, deflected and truncated; base much undulated; mouth and vertex excentrical.

Height $\frac{6}{10}$ths of an inch, antero-posterior diameter 1 inch and $\frac{13}{20}$ths, transverse diameter 1 inch and $\frac{14}{20}$ths. In consequence of the fracture of the summit of the crest, the true height cannot be exactly ascertained.

Description.—This species is remarkable for the prominent gibbous crest formed by the anterior interambulacral and single ambulacral areæ, and which gives value to its specific name; on the anterior border of the crest a groove is formed which extends from thence to the mouth; the anterior lateral are more contracted than the posterior lateral borders, and the posterior half of the test is less elevated than the anterior half, and gradually declines from the vertex to the single interambulacral area, which is abruptly truncated. The single and the anterior pair of ambulacra form nearly straight lines from the vertex to the circumference; the posterior pair are gently sinuous; the pores are disposed in close-set pairs on the dorsal surface, but are more wide apart at the base. The interambulacral areæ are of unequal width; the anterior pair are the narrowest, the posterior pair are one-third wider than the anterior, and the posterior single area is the widest; its dorsal part is occupied by the anal valley, which is wide and deep above and expanded below, and forms an inconsiderable prominence which is abruptly truncated and much deflected posteriorly; the anus is a large, oval opening, perforated at the extremity of the valley. The mouth is situated immediately under the vertex, and both are slightly excentrical; the mouth-opening has a pentagonal form, and lies in a considerable concavity, the base being much undulated from the convexity of the interambulacra and the straightness of the valleys formed by the ambulacra. In the specimen before me the apical disc is unfortunately broken with the summit of the gibbous crest. The test is very thin, and covered with small homogeneous tubercles, which are larger, more numerous, but less regular on the base than on the dorsal surface; they are all surrounded by a very apparent circular depression.

Affinities and differences.—In its general outline *H. gibberulus* resembles the young of *H. agariciformis*, but its anterior gibbous crest distinguishes it at a glance from that species, and I know of no other form for which it could be mistaken.

Locality and stratigraphical range.—This is a rare Urchin: I know only four British specimens, the best of which, from the cabinet of W. Walton, Esq., of Bath, has served for the foregoing description, and to whom I beg to record my thanks for his courtesy in forwarding it. This Urchin was collected by that gentleman from the Inferior Oolite in the parish of Charlcomb near Bath, from whence three of the four specimens were obtained; the fourth was found in the Inferior Oolite of Dorsetshire, and is in the Museum of Practical Geology.

History.—First figured and described by M. Agassiz, who only knew of two specimens from the Inferior Oolite of Switzerland; afterwards by M. Desor in his valuable monograph on the *Galerites*, and now described as a British fossil for the first time.

[To be continued.]

VIII.—*Upon the Production of Mollusks in* Holothuriæ. By Prof. Müller*.

In our last Number we gave a translation of a very remarkable paper bearing the above title, which had been read by Prof. Müller before the Academy of Sciences in Berlin on the 23rd of October 1851. Considering the length of this communication, the elaborate manner in which it entered into details, the importance and very startling nature of the presumed discovery, the dignity of the scientific body to which it was addressed, and the high reputation of its author, we did not doubt that the statement as to facts was complete, and that the reasonings thereupon were mature and well-weighed. Although therefore we could not help pointing out the most obvious weak points of the argument, respect for what seemed the fixed conviction of a very eminent man, prevented more than a feeble protest.

The new essay, whose title stands at the head of the present article, bears date December 1851, five or six weeks therefore later than the previous one, and this five or six weeks has been sufficient to effect a very considerable change in the whole aspect of the matter; the alteration being such, we are happy to say, as more than justifies the criticisms upon which we ventured.

Let it not be imagined that the differences are such as would

* Ueber die Erzeugung von Schnecken in Holothurien. Von Joh. Müller. *Müller's Archiv*, 1852, No. 1.

naturally exist between a mere abstract of a paper and the paper itself. It is very clear that the account read before the Academy contained a full statement of all that its author then thought upon the subject; for, with the exception of one or two passages which have been altered, the present essay is identical *verbatim et literatim* with the former, differing merely in the presence of very considerable interpolations at various places. The smaller proportion of the added matter consists of new facts, the larger of speculation somewhat cooled as it would seem by further consideration.

The principal new fact of importance (and its significance is very great) is, that the molluskigerous sac has been found together with the ordinary generative organs in two cases.

At page 5 of the 'Archiv' we find—

"One of the first questions which arose was, whether the individuals with a molluskigerous sac also possess the ordinary generative organs or not. The solution of this problem seems easy enough, but was in truth very difficult, on account of the violent rupture of the viscera by the spontaneous fission of the animal—whence the genital sacs were not unfrequently torn away from their attachment in the head. From this cause the molluskigerous sacs were most frequently and readily found in those portions of the body which had already become separated from the head. In all those portions containing molluskigerous sacs which I examined in Trieste, I sought in vain for the ordinary genitals. On renewing my investigations here, however, upon a large number of specimens preserved in spirits in which the head was retained, I found two which possessed the ordinary generative organs as well as the molluskigerous sac. These generative organs indeed were not so large and completely developed as they commonly are, but they contained quite normally-formed ova of *Synapta* of $\frac{1}{33}$rd of a line in diameter. The collective number of observations is by these increased to seventy-one: and we must consider it as proved, that the presence of the molluskigerous sac does not exclude the ordinary generative organs and *vice versâ*."

Although the co-existence of the two organs has been absolutely observed in *two* cases only out of seventy-one in which the molluskigerous organ was found, a consideration of the nature of the evidence will lead to the belief, that we must not thence conclude that their co-existence is at all rare.

The *Synaptæ* were always found in fragments. The inclosure of either generative organs or molluskigerous sac in any of these fragments would depend either upon their being attached to some portion of the fragment or upon mere chance.

Now the generative organs are attached to the head only.

The molluskigerous organ, on the other hand, was observed to be attached to the head in one instance, while in twenty other cases it was attached to the intestinal vessel alone. Whether it has normally a cephalic attachment or not then, at any rate the intestinal attachment is by far the stronger. When the animal breaks up, it appears that the head usually separates from the portion containing the intestinal attachment of the molluskigerous sac, and hence there is an *à-priori* probability that the molluskigerous sac will not be found with the genital organs.

Even should the latter break off from their cephalic attachment and become perfectly free, it is just as likely that they should slip into, and be inclosed in, some other fragment, as in that which contains the sac.

No value therefore can be placed on negative evidence in this matter; and for anything that appears to the contrary, the molluskigerous sac and the generative organs may always co-exist.

There is further, evidence to show that the molluskigerous sac does not, as Prof. Müller had supposed, replace the ordinary generative organs.

Speaking of the three sacs whose cephalic attachment was observed (Annals, p. 30), he says (Archiv, p. 17):—

"The attachment of the three sacs was close together between the calcareous ring and the cephalic disc near the point of insertion of the vesicula Poliana.

"Hereabouts usually, the main stem of the generative organs lies, but in the present case no trace of it was to be found. Unable to investigate the matter further in fresh preparations, I nevertheless thought it probable that the sacs opened here, partly because I had not at that time discovered the generative organs in any *Synapta* provided with molluskigerous sacs; partly because in the last-mentioned case the three sacs were attached close together at one and the same spot. Recently, however, grave doubts have arisen in my mind as to the meaning of this connexion, especially on account of the circumstance that the trunk of the generative organ opens, not between the oral disc and the calcareous ring, but close behind the calcareous ring.

"The contracted condition of the specimens preserved in spirit allowed of no further elucidation of this point.

"The third smaller sac had already in the recent state been detached for microscopic investigation; the two other larger sacs were yet attached, and could only be separated by repeated and violent tearing of their point of insertion with needles; but I could arrive at no conclusion as to the mode of their insertion and the relations of their outer extremities.

"The sacs are very fine towards their torn-off ends, gradually diminishing to $\frac{1}{10}$th of a line in diameter. Further investigations

are necessary to determine the constancy or inconstancy of this attachment, and the mode in which it is effected. And for the present I must leave undetermined how the mollusks make their exit, whether by the spontaneous breaking up of the *Synapta* or through the spiracula described by Quatrefages (which however I have not been able to discover), or by the continuation of the sac itself to the outer surface."

It is quite clear then, that whatever the sacs may be, they are not homologous with any normal organ of the *Synapta*, which clears off one considerable difficulty in the way of the parasitic view.

The structure of the small third molluskigerous sac mentioned at p. 30 seems worthy of more attention than Prof. Müller has allotted to it, and may perhaps, if attentively considered, throw some glimmer of light upon the nature of the sacs.

Prof. Müller expresses a doubt whether this delicate and short sac was a young undeveloped, or an old retrograding form. However, when we consider "that the ovarian capsule and the contour of the ovary were visible in this sac, but no yelks or yelk-granules" (Archiv, p. 17), or secondary capsules containing yelks; and further, that in fully developed sacs when the yelks have made their exit the ovarian capsule dehisces (Annals, p. 28); it seems pretty certain that it must have been an undeveloped form, and not one which had performed its functions.

Should this be the case, however, the consequences are highly important. For this small sac contained an "intus-susception" which reached as far as the ovary (Archiv, p. 17), and the intus-suscepted end hung freely in the cavity of the *Synapta*, while the opposite end was attached to the head of the animal.

Whether the sac be an organ or a parasite, therefore, it appears that its inner end is at first free, and that eventually it must bore a hole in the intestinal artery and become organically connected therewith; and this difficulty being equal for all theories may be henceforth eliminated. The fact indeed that the sac is at first attached only to the parietes of the animal and subsequently to its viscera, speaks strongly in favour of its parasitic nature. We have an exact parallel in the course taken by the "pupæ" of *Cercaria echinata* so ably described by Steenstrup (Alternation of Generations, p. 57 *et seq.*). The *Cercaria* buries itself in the skin of the mollusk it infests, loses its active habits, and eventually reaches a particular organ, the liver. Its organization has become simplified in this course; the generative organs apparently becoming developed as the locomotive and digestive organs retrograde.

The single case in which sacs were found attached both to the parietes and to the intestinal vessel might be compared to a *Di-*

stoma pupa which had just attached itself to the liver without quite leaving the integument,—a stage through which every *Distoma* must certainly pass, though it has not been actually observed.

It is only by supposing the adhesion of the molluskigerous sac to the parietes of the *Synapta* to be a step in its progress, that one can comprehend the two seemingly opposed statements of Prof. Müller, namely that while in at least twenty cases to one the sac is found attached to the intestinal vessel only, in that one instance the adhesion of the sacs to the parietes was so strong that they could only be detached "by repeated and violent tearing with needles" (p. 17).

In the present communication Prof. Müller allows infinitely more weight to the probability of the parasitic nature of the molluskigerous sacs. At page 24 (Archiv), after considering the means of discovering the adult mollusk, we find—

"Among so many contingences, however, it is to be remembered, that possibly our mollusk may never be discovered in the adult state, but that after a short life as such it may cast off shell and operculum and change into a parasitic worm, a hermaphrodite mollusk-generator."

On such an hypothesis it is compared at p. 25 to *Lernæa* among the Crustaceans; and taking in addition the two following passages interpolated in the 'Archiv' at pp. 30–31, we may almost say that Prof. Müller has given in his adhesion to the notion of parasitism.

The first is inserted after the paragraph containing those very remarkable speculations as to the precedence of hen and egg, &c.

"This is nothing more than the logical consequence of conceiving the sac to be an extraordinary organ of the *Holothuria*; and he, who in the foregoing manner metaphysically explains the observations, only endeavours to define that conception. It need hardly be remarked, that this view is a mere abstract theory (natur-philosophische Doctrin) in the absence of that further knowledge of facts which I desire and seek for."

And a little further on we find inserted—

"The further investigation of the subject cannot proceed from the conception of its inexplicability, for this excludes all profounder knowledge; we must rather for the present take the very opposite course. Further investigation must proceed upon the basis of what we know, and explanation must be sought in the common course of nature.

"According to our present knowledge, a sac which produces mollusks can be homologous with nothing but a mollusk, whether it arise by an alternation of generations or by a metamorphosis of a mollusk. The wonderful connexion of this structure with the *Synapta*, and always with the same blood-vessel, remains then

the inexplicable point. Upon this view we hazard much less than by adopting the others; and I believe that in the course of further investigations we must hold fast by it, until the whole process has been made clear by direct observation."

It is very remarkable, that while thus decisively admitting the probability that we have to do with a case of parasitism, Prof. Müller does not go a step further, and inquire in the first place, whether the structure of the sac has any analogy with that of any known molluscous organism; and secondly, whether the mode of parasitism is analogous to other cases. We have already endeavoured to answer the latter question in the affirmative;—can the former be similarly answered?

"The question (says the Professor) is, to conceive a sexually perfect mollusk which has laid aside all molluscous characters; which has neither organs of sense, foot, liver, anus, heart, vessels, nor sexual organs of gasteropod or mollusk, and yet which possesses the faculty of discovering a particular vessel in another animal, and of nourishing itself on the blood therein contained." (Archiv, p. 25.)

A riddle, truly, that the Sphinx might have propounded; and it is not without some wholesome fear of being devoured, that we venture to suggest a possible mode of solution.

In our previous remarks, the possibility of an affirmative answer to this question was but indicated, in an allusion to the structure of *Hectocotylus*, inasmuch as we did not doubt that Prof. Müller himself would consider the subject from this point of view also. He has not done so however, and it is therefore necessary to explain the meaning of that allusion more fully.

Hectocotylus Argonautæ is developed from certain ova of the Argonaut. It is therefore homologous with a complete mollusk, not with a spermatophore. It consists of a muscular tube beset externally with two rows of suckers. There are no gills, and there is no separate abdomen.

If there be any intestine, it is a cæcal tube opening anteriorly by a small aperture; at least, such an organ exists in the *Hectocotylus Tremoctopodis*, in which species also a heart, gills, and traces of a nervous system were observed.

The testis is a delicate glassy vesicle containing spermatozoa.

These *Hectocotyli*, which may thus almost be said to "have laid aside all molluscous characters," are yet the males of the Cephalopods to whose mantle, cavity, or arms they parasitically adhere.

Suppose now, that the mollusks developed within the molluskigerous sac are not unisexual like the Cephalopods, but hermaphrodite; that after swimming freely for a while like most mollusk-larvæ (a stage which would correspond to the *Cercaria*

form of *Distoma*), they attach themselves to their appropriate nidus—a *Synapta*; then, undergoing a further development resembling in its type partly that of the Anangious Nudibranchiata, partly that of *Hectocotylus*, they bury themselves in the teguments of the *Synapta* (a stage answering to the pupa condition of the *Cercaria* or *Distoma*); that finally, growing and elongating, they attach themselves to the organ for which they are intended, and lose more or less their original form (like the *Distoma*) to become little more than mere generative organs;—supposing all this—though it is true that we suppose a great deal—yet there is no mere hypothetical assumption—not a hair's breadth do we pass beyond the limits of strong and legitimate analogy.

The discovery of the co-existence of the molluskigerous sac with true generative organs has of course obliged Prof. Müller to remodel the expression of his views with regard to the bearing of his discoveries on the Alternation-theory. Thus we find at page 26 of the 'Archiv' the following new matter:—

"The *Holothuriæ* and mollusks have, beside their calcareous deposits, and the circumstance that certain *Holothuriadæ* possess a kind of foot from which locomotive suckers can be protruded, no features of resemblance whatsoever. Indeed, according to well-founded ideas, they belong to two different divisions of the animal kingdom.

"The alternation of generations consists in the succession of two or more generations dissimilar to one another, and of which one is sexual;—upon a Heterogony, which in some one of the successive generations returns to the earlier form;—upon a Heterogony, therefore, which is effaced after a regular succession of forms. Thus it is, in the clearly made out 'alternation' of the *Salpæ*, of many intestinal worms, of the Medusa and Strobila, and of the Aphides.

"Not quite so certain—at least not absolutely known—is this return in other cases, which seem to be similar, and were included under the same category by the distinguished originator* of the alternation-doctine—Steenstrup. Of these I shall speak at the end of this essay.

"Supposing, however, that the phænomena of alternation take place rigidly according to this definition, in all cases, yet it is certain that sometimes two generations occur at the same epoch of an animal's existence, whereof only one produces its like—A from A; the other produces its unlike—B from A. With these, the phænomena presented by *Synapta* might be tentatively compared. That two *sexual* generations of different kinds should

* "Urheber." Prof. Müller seems to have forgotten his distinguished countryman by adoption—Chamisso.

occur simultaneously would differ entirely from the alternation of generations, and is self-contradictory. This, however, is by no means necessarily to be assumed in our comparison, since an aberrant generation may begin by gemmation. The completeness of the parallel depends essentially upon whether we consider two classes, like Polypes and Medusæ, whose members alternately arise in the course of the 'alternation,' as definite and separate classes, or whether they do not rather form but one class. If they be *not* two distinct classes of the animal kingdom, all ground for a comparison of our case with an alternation of generations, viz. an alternation between *Holothuriæ* and mollusks, ceases; for these are unquestionably separated by a much wider gap than Medusæ and Polypes.

"It is now worth while, concisely, to sum up the various possibilities. The dilemma is, either the molluskigerous sac is itself an animal, or it is an organ of the *Holothuria*. In the one alternative, as in the other, we have to deal with phænomena of the strangest kind. If the sac be an animal, a worm, not produced by the *Holothuria*, but arisen from a mollusk, we have perchance a quite unexpected case of the alternation of generations. To believe this would perhaps be the easiest mode of reconciling ourselves to facts so anomalous. We have become accustomed in this region to much that is wonderful and yet has accommodated itself to the law, so that we must not readily be startled.

"Or there is no alternation, but a metamorphosis takes place. The mollusk metamorphoses itself into a parasitic worm, which again produces mollusks—a wholly unexpected but by no means an irrational supposition.

"If the sac be a worm produced by the *Holothuria*, then it is much more incomprehensible and wonderful, and surpasses any conceivable mode of 'alternation.'

"If the sac be no animal, no worm, but an extraordinary organ of the *Holothuria*, it is still perfectly inexplicable, and becomes an ultimate fact by which other facts may be explained."

We can but remark here, that the want of a clear distinction between gemmation and generation, between an animal and an organ, appears to produce a singular confusion of ideas.

"That two sexual generations of different kinds should occur simultaneously" certainly differs entirely from any known "alternation;" but why it should be "self-contradictory," we are at a loss to discover. However improbable such an occurrence may be, it is difficult to see why it should be impossible. Besides, Prof. Müller *does* assume it to occur, if he considers that the molluskigerous sac is produced within the *Synapta*. Supposing that sac to be produced by gemmation within the *Synapta*, is it any the less an organ of the *Synapta*? If it be, then the water-

vascular system of a *Holothuria* is not an organ of the *Holothuria*, and the allantois is not an organ of the mammalian fœtus.

As for the Medusæ and Polypes being distinct classes of the animal kingdom in any sense in which the word class can be applied to mollusks and *Holothuriæ,* zoologists have been so long agreed, that it seems hardly worth while to have raised the question.

A considerable amount of new matter is added by Prof. Müller with respect to the possible sexual development of Medusæ, from Medusæ which have proceeded from Polypes, but our space will not permit us to enter upon that subject. One observation only we would make, namely, that supposing Prof. Müller's hypothetical, most favourable case, to be discovered, *i. e.* the sexual development of a *Sarsia* or the like, from a *Sarsia*, there would not be the slightest analogy with the supposed process in *Synapta*. To have a parallel case, not only must we find a *Sarsia sexually propagated from a Sarsia, but we must find Polype-producing sexual organs upon the Polype whence the Sarsia has proceeded.* There is not at present the slightest evidence that such a case as this either exists or is likely to be discovered.

Having now placed the reader in the possession of all the facts, we must conclude, not without regret that the present article should, by the very necessities of the case, have taken so controversial a tone. Prof. Müller, however, needs not our praise, and will, we hope, consider our free criticism as a much higher testimony to the weight of his authority and the value of his opinions, than any laudation.

Indeed, as in the instance of his admirable researches upon the Echinoderms, we trust that he will be the first to throw the clear light of observation upon the mysterious obscurity with which this interesting subject is invested, and so restore the zoological world to its propriety, from which his announcement had well nigh frightened it.

We cannot end better than with two excellent passages, in which some finger-posts are set up for future travellers in this path :—" For the present the solving of this problem is impossible, but on the other hand, the kind of work necessary for its solution may be readily pointed out. We do not yet know all that is to be seen in *Synapta digitata,* and there are other kinds of *Synapta* to be investigated. The spermatozoa of the genera of the Pectinibranchiata, and also in other families of the Gasteropoda where they are as yet unknown, must be made out. We must learn those of not only one species of *Natica,* but of all kinds which occur in the Mediterranean and Adriatic seas. We must ascertain the nature of the yelk in *Natica,* or those species of mollusks to which the nature of the spermatozoa guides us.

Lastly, we must know the spawn and brood of those kinds of *Natica* or other mollusks" (Archiv, p. 29.).

"I do not give up the hope, that we may yet determine at least the genus of this mollusk; and I found this hope mainly upon the very characteristic form of the spermatozoa, in addition to the other features enumerated.

"It is very interesting, that from the form of the spermatozoa, our mollusk can hardly belong to either the Nudibranchiata or the Tectibranchiata, whose linear spermatozoa have been made perfectly well-known by Kölliker. This is so much the more worthy of notice, since it is in harmony with the indications afforded by the shell and by the general structure of the young mollusk, from which the animal would be referred to the Pectinibranchiata.

"Among these, the peculiar form both of the shell and of the spermatozoa excludes the Canalifera from consideration. But among the Trochoidæ to which *Natica* belongs, cercariform or knitting-needle-shaped spermatozoa occur among a few genera, and were observed by Kölliker in *Trochus cinerarius*, L. Wagner, Erdl, and Kölliker observed similar ones in *Patella* and *Chiton*. Wagner and Erdl found them in *Haliotis* among the Scutibranchiata, and Siebold in *Vermetus* among the Tubulibranchiata. The spermatozoa of *Natica* and its allies are yet unknown.

"In investigations with reference to this matter, it will be especially important to recollect the terminal enlargement of the spermatozoa, which up to this time has been observed in no Gasteropod, but in the spermatozoa of our mollusk is never wanting."

IX.—*Brief Diagnostic Notices of new Maderan Land Shells.* By R. T. Lowe, M.A.

Vitrina, Drap.

1. Vitrina Behnii.—Prim. (in Trans. Cam. Phil. Soc. vol. iv. Part 1), tab. 5. f. 1 *b*. *V. Ruivensis*, Couth. Pf. Mon. ii. 507. Differt a *V. Lamarckii*, Fér. (Prim. *loc. cit.* f. 1 *a*) testa haliotoidea patula depressa, apertura auriformi ad apicem usque pervia, anfractibus tantum duobus, spira laterali vix ulla, &c.; necnon animale.

Speciem icone supra citata distinctam, et plures jam annos in honorem cl. Professoris Kielensis dicatam stabilivi.

Hab. in Madera.

Helix, L.

§. *Leptaxis*, Lowe.

2. Helix membranacea.—Ab *H. furva*, Lowe, juniore caute

distinguenda. Differt testa tenuiore flexili fere membranacea, semper imperforata, efasciata, lacteo coagulatim liturata, carina obsoletiore.

Hab. in Madera.

3. Helix hyæna.—*H. erubescenti*, Lowe, proxima. Differt testa majore tenuiore inflatiuscula omnino ecarinata, subtus convexiore, colore fulvo intensiore, distinctius fusco subquinquefasciata, apertura magis rotundata, peristomate simplici, nec intus sublabiato.

Hab. in Insula Deserta Australi.

4. Helix fluctuosa.—*H. phlebophoræ*, Lowe, affinis. Differt testa subtrochoideo-depressa acute carinata lævigata s. obsolete malleata, spira depressa, sutura parum impressa, anfractibus planiusculis, ultimo subtus convexo, apertura transverse ovato-lunata, labris disjunctis.

Hab. semifossilis in Portu S[to]. Collegit amiciss. T. V. Wollaston, Arm.

5. Helix psammophora.—*H. phlebophoræ*, Lowe, affinis. Differt testa tenuiuscula subtiliter arenoso-granulata striolisque spiralibus subtilissime decussata, striata nec undulatim plicato-costellata.

Hab. semifoss. in P[tu] S[to]. Coll. Wollaston.

6. Helix craticulata.—*H. phlebophoræ*, Lowe, proxima. Differt testa minore tenuiore globulosa ruguloso-cancellata vel reticulatim scrobiculata, anfractibus convexioribus, coloribus lætioribus s. fasciis distinctis.

Hab. in Insula Ferro juxta Portum S[tum]. Coll. Wollaston.

7. Helix vulcania.—*H. Porto-sanctanæ*, Sow., magnitudine formaque similis. Differt testa imperforata, subundulatim æquistriata, glabra (nec hispido-granulata), virescente, fusco bi- (nec tri-) fasciata, peristomate intus costa annulari marginato.

Hab. in Insulis Desertis Majore et Minore.

8. Helix leonina.—*H. vulcaniæ* affinis. Differt testa magis globosa, tenui, subinflata, fulvo-flavescente, obsolete undulato-striata, peristomate simplici.

Hab. in Insula Deserta Australi.

§. *Xerophila*, Held.

9. Helix armillata.—*H. striata*, Drap. ? Prim. 53. no. 44. *H. Lowei*, Pot. et Mich. Pf. i. 149. nec Fér. *H. striatæ*, Drap. affinis. Differt testa minore omnino magis depressa, umbilico majore largiore, anfractibus convexioribus distinctioribus, sutura profundiore, peristomate simplici nec intus costato-annulato.

Ab *H. conspurcata,* Drap., differt testa nunquam hispida, umbilico patulo largiore, &c.

Hab. in Madera.

§. *Theba,* Leach.

10. Helix ustulata.—*H. pisanæ,* Müll., proxima. Differt testa subimperforata subconoidea semper ecarinata, spira elevata subpyramidata, anfractibus convexis, ultimo subtus subinflato, sutura distincta, perforatione clausa obvelata, peristomate simplici, nec intus costato-annulato.

Hab. in Insulis "Salvages."

§. *Plebecula,* Lowe.

11. Helix giramica.—*H. vulgatæ* (*H. nitidiusculæ,* Lowe, Pf., nec Sow.) proxima. Differt testa majore largiore s. minus compacto-globosa, intensius colorata, fasciis spadiceis duabus superioribus sæpissime confluentibus, tertia inferiore latiore, umbilico majore subpatulo. *H. nitidiuscula β,* Pf. Mon. i. 197, eadem videtur.

Hab. in Madera Insulaque Deserta Minore.

12. Helix vulgata.—*H. nitidiuscula,* Prim. 52. no. 40. t. 6. f. 6 (omissis syn. Sow. verbisque "et Portu S^to^"); Pf. Mon. i. 196 (omiss. syn. Sow.). *H. nitidiuscula,* Sow., vera est *H. lurida,* Prim. 52. no. 39. t. 6. f. 5; Pf. Mon. i. 197. no. 510.

Hab. in Madera vulgatiss. In Insulis Desertis minus frequens. In Portu S^to^ omnino deest.

13. Helix canicalensis.—*H. vulgatæ* proxima nimis affinis, forsan var. tantum. Differt spira paullo elevatiore subturrita apice acuto prominente, anfractibus convexioribus distinctioribus, sutura magis impressa, testa solidiore crassiore rudiore.

Hab. semifoss. in Madera.

§. *Irus,* Lowe.

14. Helix laciniosa.—Species pulcherrima, *H. depauperatæ,* Lowe, affinis, sed umbilico strictiore, testa intensius colorata distincte fasciata, haud granulata, arcte plicato-striata, epidermide ad strias in lacinias excurrente tota echinato-aculeata, aspera.

Hab. in Insula Deserta Minore s. Septentrionali.

15. Helix squalida.—*H. depauperatæ,* Lowe, etiam affinis. Differt testa minore erosulo-scrobiculata nec granulata, umbilico majore largiore, &c.

Hab. in Madera semifoss. vulg.; recens rariss. Coll. Wollaston.

§. *Spirorbula,* Lowe.

16. Helix latens.—*H. obtectæ,* Lowe, proxima. Differt

testa tenuiore fere membranacea flexili, diametro transverso majore, spira planiore fere immersa, anfractibus paucioribus.

Hab. in Madera. Coll. Wollaston.

§. *Buromphala*, Beck.

17. Helix Gueriniana.—Species elegantissima pulchre et læte colorata, *H. rotundatæ*, Müll., proxima, sed vere distincta. Differt testa pellucidiore, lætius colorata, carina acutiore, spira valide et remote costata nec arcte striata, anfractibus pluribus, ultimo infra carinam omnino lævigata lucida nitente, umbilico multo majore largiore ampliore.

Hab. in Madera. Prima coll. Jemima Carolina Guerin.

§. *Lucilla*, Lowe.

18. Helix scintilla.—*H. crystallinæ*, Drap., affinis. Differt umbilico largo patulo spirali, colore pallide virescente, &c. Ab *H. pulchella*, Müll., juniore differt nitore, umbilico majore, anfractibus magis æque crescentibus pluribus. Ab *H. excavata*, Bean, differt testa multo minore discoidea, colore, anfractibus paucioribus. Ab *H. radiatula*, Ald., æque ac ab *H. cellaria*, Müll., juniore magis ac magis recedit.

Hab. in Madera.

§. *Janulus*, Lowe.

19. Helix calathus.—Species elegans, *Hylostomatibus*, Alb. analoga, *H. bifronti*, Lowe, affinis. Differt testa minore, forma magis compacta, spira elevatiore castaneo-subtessellata, anfractibus pluribus distinctius transverse concinne et arctissime costatis spiraliterque exilissime striatis, umbilico paullo majore, apertura callo intus 4-lamelloso-plicato.

Hab. in Madera.

§. *Hispidella*, Lowe.

20. Helix Armitageana.—*H. revelatæ*, Fér., necnon *H. sericeæ*, Drap., affinis. Differt striis exilissimis flexuoso-capillaceis spiralibus, ad interstitia strias transversas membranaceas decussantibus, testa depressiore subcarinata, fusco bifasciata. Testa admodum tenuis perfragilis pellucens, pallide brunnea, virescens, arcte et minute hispida. Perforatio cylindrica nec pervia, parva. Animal muco scatet.

Hab. in Madera. Coll. Armitage et Wollaston.

§. *Caseolus*, Lowe.

21. Helix sphærula.—Inter *H. compactam* et *abjectam*, Lowe, media. Ab *H. compacta* differt testa magis grosse v. distinctius (præsertim subtus) granulata, forma magis conico-tro-

choidea, labro ad axin expanso calloso-reflexo. Ab *H. abjecta* differt testa magis lævigata (nec rudi, anfractibus inæqualiter costatis), carina obsoletiore, perforatione minore, labrisque disjunctis (nec ore circinato). Differt ab utraque labro deorsum intus calloso.

Hab. semifoss. in Madera.

§. *Discula,* Lowe.

22. Helix pulvinata.—*H. polymorpha ζ. pulvinata,* Prim. 56. Differt ab *H. polymorpha α,* Lowe, testa minus grosse granulata, subtus planiore, umbilico majore latiore, nec parietibus declivibus, carina acutiore inferiore, sutura magis impressa, anfractibus semetipsis quasi superimpositis.

Hab. in Portu S^to^.

23. Helix attrita.—*H. polymorpha δ. attrita,* Prim. 55. t. 6. f. 14. *H. tectiformis,* Wood, Suppl. t. 8. f. 83 (nec Sow.). Forma et habitu peculiari ab affinibus omnino distincta.

Hab. in Portu S^to^.

24. Helix tabellata.—Species tenuitate, spira tabellata attrito-planata, umbilico patulo spirali ab affinibus distinctissima. *H. maderensem,* Wood, quodammodo refert, sed testa prætenui discoideo-planata prorsus aliena.

Hab. in Madera.

25. Helix senilis.—*H. linctæ,* Lowe, proxima. Differt testa magis depressa, subtus convexa, tota scabra grosse granulata, spira subplanata, anfractibus attritis planatis, sutura subobsoleta, carina acuta limbata supera.

Hab. in Insulis Desertis Majore et Minore.

26. Helix poromphala.—*H. senili* proxima, nimis forsan affinis. Differt umbilico minuto poriformi parietibus minus declivibus, spira elevatiuscula anfractibus convexiusculis distinctis, sutura subimpressa, carina subacuta exacte media. Testa quoque minor, magis fere lucida.

Hab. in Deserta Australi.

27. Helix lincta.—*H. polymorpha β.* et *γ,* Prim. 54. t. 6. ff. 12, 13. Differt ab *H. polymorpha α.* testa discoidea minus rude granulata, subtus præsertim lucida, umbilico subpatulo spirali nec parietibus subdeclivibus.

Hab. in Madera.

28. Helix papilio.—*H. polymorpha ε. calcigena,* Prim. 56. t. 6. f. 15. Differt ab *H. lincta* testa subtus fere egranulata lævi, anfractibus planiusculis subindistinctis, carina acuta nec obtusa, umbilico patulo largiore. Sequenti nimis affinis; differt præci-

pue testa subtus fere lævi. Testa subtus læte alba, fasciis interruptis pallidis castaneis vel fulvis, ab utraque specie differt.

Hab. in Insula Baxo juxta Portum S^{m}.

29. Helix discina.—Differt ab *H. papilione* colore, testa magis depressa tota exilissime reticulato-granulata, anfractibus magis planatis attritis, sutura obsoleta.

Hab. in Portu S^{to} vulg.

30. Helix testudinalis.—Species inter nobiliores ob magnitudinem et colores pulcherrime testudinales enumeranda. *H. papilioni* et *discinæ* proxima; sed duplo fere major nitidiuscula, supra exilissime granulata et arcte striata, subtus convexa lævis lucida, anfractibus convexiusculis, sutura impressa, carina obtusa supera (nec media), linea angusta fusca distinctissima supra carinam, eamque quasi duplicante, usque ad apicem fere supra suturam continuata.

Hab. in Portu S^{to}. Coll. Wollaston et Armitage.

§. *Tectula,* Lowe.

31. Helix Lyelliana.—*H. Bulverianæ,* Lowe, similis. Differt testa lævi, supra omnino egranulata, spira trochiformi apice minus obtusa nec cupuloidea, anfractibus minus attritis sutura distinctiore, umbilico minus profundo, labro reflexo infra carinam descendente, apertura ad carinam haud angulata.

Hab. in Deserta Majore.

32. Helix Albersii.—Species eximia inter insigniores, in honorem cl. J. C. Albers, M.D., Helicosophi peritissimi necnon taxophilorum omnium optime meriti dicata. *H. Bulverianæ* similis differt testa subminore solidiore trochiformi colore cerinocorneo magis opaco, minus (præsertim juniore) planato-depressa, subtus convexiore, carina media minus limbato-prominente, apertura ad carinam haud angulata.

Hab. in Portu S^{to}.

§. *Craspedaria,* Lowe.

33. Helix Delphinula. Prim. 64.—*Delphinula,* Bowd. Exc. 140. figs. 33 *a, b.* Species mirabilis, *H. turcicæ,* Chemn., affinis. Differt umbilico patulo parietibus haud carinato-declivibus, apertura circulari, labro relevato expanso-reflexo sinuato-dentato v. inciso quasi fimbriato.

Hab. semifoss. in Madera.

§. *Coronaria,* Lowe.

34. Helix coronula.—Species perelegans, *H. tiarellæ,* Webb, affinis. Differt testa discoideo-depressa, subtus exquisite can-

cellata ecarinata, anfractibus supra acute carinatis, umbilico largo patulo profundo pervio.

Hab. in Deserta Australi.

35. Helix juliformis.—Species pulchella perquam singularis subpellucida, subtus subopaco-lactea, supra pallide cornea, *H. coronulæ* affinis. Differt testa magis depressa discoidea, subtus costis flexuosis remotis rotato-radiantibus nec cancellata, striis spiralibus nullis, anfractibus supra obtuse carinatis, apertura valde constricta quasi duplicata trigona, labro intus unidentato. Apertura *H. pauperculam*, Lowe, refert.

Hab. in Portu S^to^. Coll. Wollaston et Armitage.

§. *Placentula*, Lowe.

36. Helix spirorbis.—*H. maderensi*, Wood, proxima, sed multo minor fere unicolor fasciisve obsoletis, testa tota granulata magis discoidea, spira depressiore apice obtusissima, anfractibus convexioribus (nec attritis) sutura impressa tenuiter et æquistriatis, nec hic inde stria rudi validiore quasi varicosis, carina media obtusiore, umbilico majore magis perspectivo.

Hab. in Madera.

37. Helix fictilis.—*H. dealbatæ*, Lowe, proxima. Differt testa omnino egranulata nitida lævi, plerumque distincte fasciata, magis discoidea, spira depressiore, carina distinctiore, umbilico largo patulo majore. Testa omnino minus rudis, plerumque (in *α*.) minor. Var. *β*. est *H. dealbata β*. Prim. 48.

Hab. in Portu S^to^.

38. Helix micromphala.—*H. fictili* proxima. Differt testa tota subtiliter reticulato-granulata, spira elevatiuscula, umbilico minuto subporiformi.

Hab. in Insulis Desertis Majore et Minore.

§. *Actinella*, Lowe.

39. Helix stellaris.—Species parvula fere minuta, *H. lentiginosæ*, Lowe, nimis affinis, et forsan var. tantum pusilla; sed duplo fere minor, solidior, magis lævigata, subnitens, terra v. limo arcte obducta, peripheria eximie calcarata s. epidermide stellatim radiata. Ab *H. arcta*, Lowe, cui magnitudine persimilis, testa tenuiore, tota scobinata, tenui- (nec grosse) striata, umbilico majore subpatulo, laminaque ventrali nulla statim dignoscitur.

Hab. in Madera. Coll. Wollaston.

§. *Rimula*, Lowe.

40. Helix obserata.—*H. faustæ*, Lowe, proxima, sed paullo

major, minus globosa, magis discoidea, carina acutiore, subtus convexior, plica laminave ventrali nulla, perforatione omnino clausa quasi obserata. Inter *H. faustam* et *H. rotulam*, Lowe, intermedia.

Hab. in Madera.

§. *Iberus*, Montf.

41. Helix Wollastoni.—Speciem statu semifossili a meipso A.D. 1828 olim inventam, vivam inter Helices Maderenses pulchritudine superbientem detexit Entomologicus peritissimus necnon Molluscorum Maderensium scrutator oculatissimus indefessus felicissimus Wollaston. *H. scabriusculæ*, Desh., affinis. Differt colore virescenti-castaneo spadiceo fasciato, carina media (nec supera) ad suturam immersa nec per spiram prominente, perforatione omnino nulla, labro simplici (nec reflexo), axin versus late dilatato, verticaliter deciso v. planato, roseo.

Hab. in Portu S^to^. Inv. Wollaston.

Bulimus.

§. *Zua*, Leach.

42. Bulimus maderensis.—*Helix C. lubrica*, Prim. 61. t. 6. f. 29 (haud Müll.). A *B. lubrico*, Müll., testa graciliore angustiore, aperturaque quoad longitudinem totam breviore, latitudinem testæ sc. æquante, constantissime differt.

Hab. in Madera.

Achatina.

§. *Cylichnidia*, Lowe.

43. Achatina Leacociana.—Testa parvula subminuta, *Bul. maderensi*, Lowe, forma et colore persimilis, *Achat. folliculo*, Gron., affinis. Ab hac differt, præter magnitudinem, forma e basi latiore sensim decrescente, apertura sursum subangustata, labro sursum arcuato-prominente, columella basi distincte truncata prominente. Differt ab *Achat. gracili*, Lowe, forma oblongiore nec fusiformi, spira obtusissima, apertura sursum subangustata labroque arcuato-prominente, columella basi prominente distincte truncata v. emarginata. Ab *Achat. cylichna* et *ovuliformi*, Lowe, quibus affinitate naturali proxima, apertura edentula statim dignoscitur.

Hab. in Madera. Inv. T. S. Leacock.

44. Achatina cylichna.—Species notabilis pulchella, *Achat. ovuliformi*, Lowe, affinis. Differt apertura ringente 5-plicata, anfractibus planatis, apice obtusiore, labro intus triplicato.

Hab. semifoss. in Madera.

§. *Fusillus*, Lowe.

45. Achatina oryza.—*H. triticea β. edentula*, Prim. 61. t. 6. f. 26. Differt ab *H. triticea*, Lowe, apertura spira longiore, spira breviore, plica ventrali nulla obsoletissimave, columellari plane nulla.

Hab. in Portu S[to].

46. Achatina tuberculata.—*Achat. oryzæ* proxima. Differt testa majore, forma ventricosiore (ut in *Achat. tornatellina* Lowe) magis abbreviata, apertura longiore, spira breviore, ventre sursum obsolete calloso-tuberculato.

Hab. in Portu S[to].

47. Achatina terebella.—Differt ab *Achat. oryza* testa graciliore tenuiore inter illam et *Achat. gracilem*, Lowe, intermedia, huic propior, sed colore magis fusco-corneo intensiore, minus splendide hyalino-lævi, testa ventricosiore, spira breviore, apertura longiore, labro subarcuato-prominente distincta.

Hab. in Portu S[to]. Coll. Wollaston et Armitage.

§. *Acicula*, Risso.

48. Achatina producta.—*Achat. aciculæ*, Müll., affinis, sed testa duplo majore solidiore robustiore aspectu omnino distincta. Ab *Achat. gracili*, Lowe, testa solidiore nec hyalina, apertura sursum oblique retro producta et angustata, columella basi prominente distincte truncata v. emarginata differt.

Hab. in Deserta Australi.

§. *Amphorella*, Lowe.

49. Achatina mitriformis.—*Achat. tornatellinæ*, Lowe, affinis. Differt testa graciliore magis elongata, apertura breviore, spira longiore, &c. Species proculdubio distincta.

Hab. in Madera.

X.—*On the probable Dimensions of* Carcharodon Megalodon *from the Crag.* By J. S. Bowerbank, F.R.S., L.S. &c.*

When we view small portions only of extinct animals, such as teeth or fragments of bone, there is often a considerable degree of difficulty in picturing in our minds anything like the size and proportions of the creature to which such remains have belonged, and it is with a view of endeavouring to realize in our imaginations the fish to which the great teeth of *Carcharodon Megalodon* from the Crag has belonged, which has induced me to introduce this subject to your notice on the present occasion.

* Communicated by the author, having been read at the Meeting of the British Association in July, 1851.

There is little hope that the remains of perfect jaws, or even fragments of such, should be found in the Crag formation, and it is only therefore through the means of the teeth or vertebræ that we may expect to arrive at anything like an approximation to the history of this gigantic shark. The nearest approach to the size of the teeth of *Carcharodon* with which I am acquainted, in the recent state, is presented by the jaw of a large specimen of *Carcharias glaucus,* or blue shark, that was killed at Port Fairy in Australia in 1846, in the presence of a friend of mine. It had so plagued the crew of a whaler by dashing in upon them as they were flinching a whale alongside of the ship, and carrying off large masses of blubber, that they suspended their operations, baited a hook and took it; and the capture amply repaid them, as the blubber they recovered from its maw produced a barrel and a half of oil. A similar specimen, but slightly inferior in size, was killed by the crew of the Beagle Surveying Ship, Capt. Fitzroy, and this fish measured 37 ft. in length; we may therefore safely assume that number of feet as the length of my specimen. Knowing thus the length of the fish, and having the jaw in my possession, it struck me that by the size of the tooth, in proportion to the lateral and perpendicular expansion of the jaw, as well as to the whole length of the animal, I might arrive, by comparison with the tooth of *Carcharodon Megalodon,* at a tolerably accurate approximation to the length and proportions of the latter.

The length of the largest teeth of the lower jaw of the Australian species, *Carcharias glaucus,* from the base line to the apex, is $2\frac{5}{8}$ inches. The vertical gape of the jaw is $25\frac{1}{2}$ inches, or $10\frac{1}{5}$ times the length of the tooth. The horizontal gape is $20\frac{1}{2}$ inches, or $8\frac{1}{5}$ times the length of the tooth.

The length of the animal being 37 ft., it equals $169\frac{1}{7}$ times the length of the tooth.

If we assume the dimensions of this species and apply them to the great fossil teeth of *Carcharodon Megalodon,* which is $4\frac{5}{8}$ inches long, the dimensions of that species will be as follows:—

$10\frac{1}{5}$ lengths of tooth			$=47$ inches for the vertical gape.
$8\frac{1}{5}$	,,	,,	$=38$,, ,, horizontal gape.
$169\frac{1}{7}$	,,	,,	$=65$ ft. $2\frac{1}{4}$ in. for the length of the fish.

And on these proportions a diagram may be constructed, so as to realize to the eye as nearly as possible the vast dimensions of the jaws of the fish to which the tooth of *Carcharodon Megalodon* must have belonged. But great as these dimensions appear, I believe them to be considerably under-estimated; for if we compare the jaw of *Carcharias glaucus* with that of the common

West Indian species, we shall find that the proportions of the teeth of *Carcharodon Megalodon* are much more in accordance with those of that shark than they are with the recent *Carcharias*. Let us therefore see what dimensions will arise by comparison of the fossil with the West Indian shark. Length of tooth of a West Indian shark from the base line to the tip, $\frac{7}{8}$ inch. The vertical gape is 12 inches, or $13\frac{5}{7}$ lengths of the tooth. The horizontal gape is $13\frac{3}{4}$ inches, or $15\frac{5}{7}$ times the length of the tooth. If therefore we take this species as the base of our calculations in estimating the fossil one, the size will be very much increased, and the following will be the result:—Length of fossil tooth $4\frac{5}{8}$ inches. Vertical gape of jaw $13\frac{5}{7}$ times the length of the tooth will equal $63\frac{3}{8}$ in., or 5 ft. $3\frac{3}{8}$ in. Horizontal gape of jaw $15\frac{5}{7}$ times the length of the tooth will equal $72\frac{5}{8}$ in., or 6 ft. $0\frac{5}{8}$ in. Thus estimated the dimensions of *Carcharodon* will be very considerably greater, and they will stand in comparison with each other as follows:—

Vertical gape	by first estimate	3 ft. 11 in.,	by second	5 ft. $3\frac{3}{8}$ in.
Horizontal	„ „	3 ft. 2 in.,	„ „	6 ft. $0\frac{5}{8}$ in.

very nearly, by comparison with the West Indian species instead of with the Australian one, doubling the dimensions of the fossil fish: but probably the truth will lie in the mean between the two estimates; and this is the more probable, as we find great latitude in size and proportions existing among the recent species, which vary from the common dog-fish of our coast, about 2 feet in length, to the great basking shark, which Yarrell states has been taken off Brighton 36 feet in length; and the one stranded in the Orkneys and described as a "sea serpent" is said to have exceeded 50 feet in length.

In conclusion, I may observe, that it is rather singular, that although the teeth of *Carcharodon* are tolerably abundant in the Crag, yet to the best of my knowledge no vertebræ have yet been found in that formation of a size to correspond with them; while in the London clay, shark-vertebræ 4 inches in diameter are found, without any teeth corresponding in dimensions to their great size. If we had ever found teeth of *Carcharodon* of the size of the Crag ones in the London clay, we might have reasonably concluded that they had been washed out of that formation into the Crag, as we know other well-known London-clay teeth as well as Crustacea have been; but under the present circumstances it appears to me, that they have most probably found their way into the Crag from the destruction of outlying portions of the Maltese formation, in which they are found at the present period in abundance; and this is the more probable, as they are associated in the Crag with the teeth of a second Maltese shark, *Oxyrrhina*

hastalis, not found either in the London clay or the Coralline Crag.

I have been recently favoured by Dr. W. B. Clark of Ipswich with the sight of a specimen of the tooth of *C. Megalodon,* which extends the size of the species to a considerable extent. The length of this tooth from the base line to the apex is 6 inches, which, by the same mode of estimation from the proportions of *Carcharias glaucus,* gives a horizontal gape of 4 feet 1 inch, a vertical one of 5 feet 1 inch, and a length of 84 feet 7 inches to the fish.

XI.—*Descriptions of* Rubi. By Charles C. Babington, M.A., F.R.S. &c.*

In the third edition of the 'Manual of British Botany' I have endeavoured to arrange and characterize the *Rubi* in a better manner than it was done in my former publications upon that perplexing genus, and as there are a few species which have not been brought under the notice of botanists in detailed descriptions, it seems desirable to publish such accounts of them.

1. ***Rubus Leesii*** (Bab.); caule suberecto tereti, aculeis setaceis rectis, *foliis 3-natis,* foliolis omnibus rotundato-ovatis subsessilibus imbricatis, *aculeis ramorum floriferorum* pedicellorumque paucis *setaceis basi bulbosis,* floribus axillaribus terminalibusque racemosis.

R. Idæus γ. Leesii, *Bab. Syn. Rubi,* 6.
R. Leesii, *Steele Handb.* 60; *Bab. Man.* ed. 3. 92.

Creeping very extensively. Stems erect, 2–3 feet high, clothed with short deflexed hairs and numerous very slender setaceous straight prickles with bulbous bases. Leaves all ternate; stipules subulate; petioles furrowed, with a few small prickles; leaflets similar, roundly ovate, dark green and rugose above, white and cottony beneath, midrib with few or no prickles, coarsely crenate-serrate-apiculate; lateral leaflets subsessile, overlapping the very shortly stalked terminal leaflet.

Flowering shoots short, clothed with hairs and prickles like those of the barren stem. Leaves mostly simple, cordate, slightly 3-lobed, very coarsely crenate-serrate-apiculate, green above, greenish white beneath; stipules very slender, subulate; petioles furrowed above; ternate leaves of three sessile obovate leaflets. Raceme lax, few-flowered, one or two of the lowest flowers axillary. Peduncles with very slightly curved subulate prickles. Sepals oblong, often more than five in number and then nar-

* Read before the Botanical Society of Edinburgh, January 8, 1852.

rower, with long points, downy and whitish green on both sides. Petals spathulate, acute, white. Stamens and styles white.

It is worthy of remark, that in the Cambridge Botanic Garden the strong "canes" of *R. Leesii* nearly all produced a small panicle of flowers at their extremity in the month of October 1851. In one single instance a cane of *R. Idæus* did the same. Previously to that month, neither Mr. Stratton, the Curator of the garden, nor I, had ever noticed such an occurrence in the latter, and had not had the opportunity of doing so in the former. This is a curious illustration of the tendency of all *Rubi* to attempt to increase by some action at the end of the shoot of the year. In all the arching and prostrate species it is effected by the end of the shoot penetrating the surface of the ground and taking root; in these plants, the end of whose shoots never reaches the ground, the same is attempted to be effected by flowers. The mode in which the procumbent plants succeed in penetrating the earth may be worthy of notice, for the prostrate position of their shoots seems to present a difficulty. Although the shoot is really prostrate until the autumn, at that time its extremity forms a small arch and thus presents its point perpendicularly to the ground, which it easily penetrates.

The discovery of *R. Leesii* is due to Mr. Edwin Lees, whose practised eye at once saw its probable distinctness from *R. Idæus*. He noticed it in the woods at Ilford Bridges near Linton, in North Devon, in September 1843, but could find no flowers remaining at that late period of the year. In June 1849 the Rev. W. H. Coleman pointed it out to me growing upon a dry shingly bank at Bonniton near Dunster, Somerset, and flowering plentifully. These stations, separated from each other by the high ridge of Exmoor, are distant about fourteen miles in a direct line.

The specific character of *R. Idæus* will now stand as follows:

R. caule suberecto tereti pruinoso, aculeis setaceis rectis, foliis quinato-pinnatis ternatisve, foliolo terminali longe pedicellato *lateralibus dissitis, aculeis ramorum floriferorum* et pedunculorum multis *deflexis basi dilatato-compressis,* floribus axillaribus terminalibusque corymbosis.

2. ***R. fissus,*** Lindl.

R. fissus, *Lindl. Syn.* ed. 2. 92; *Leight. Fl. Shrop.* 225; *Bab. Man.* ed. 3. 93.

R. fastigiatus, *Lindl. Syn.* ed. 1. 91? not of *W. & N.* nor *Bab.*

A full description of this plant will be found in Leighton's 'Flora of Shropshire.' In the 'Phytologist' (iii. 72) he pointed out the character derived from the prickles on the barren stem by which it is well marked.

3. *R. latifolius* (Bab.); caule procumbente vel subarcuato anguloso sulcato, aculeis parvis subdeclinatis foliis quinatis utrinque pilosis grosse duplicato-dentatis, foliolo terminali cordato acuminato, infimis sessilibus imbricatis, paniculæ brevis foliosæ pilosæ ramis ascendentibus paucifloris corymbosis apice pedicellisque tomentosis et hirtis, aculeis brevibus tenuibus declinatis.

R. latifolius, *Bab. Man.* ed. 3. 94.
R. Cramondiensis, *Bab. in lit.*

Stem usually quite prostrate, angular and furrowed throughout, nearly glabrous but with scattered subsessile glands, not stellately downy nor setose; prickles nearly all placed on the angles of the stem, rather few, moderately long, slender from a thick base, straight, declining, nearly equal. Leaves quinate, dull green and pilose above, paler and with more numerous hairs beneath, coarsely and irregularly doubly dentate; midrib and petioles yellowish beneath with a few small weak declining or slightly deflexed prickles; lower pair of leaflets broadly oblong, acute at both ends, sessile, overlapping the intermediate pair which are of similar shape but larger and shortly stalked; terminal leaflet with a stalk equalling one-third of its length, cordate-acuminate. Petioles furrowed above. Stipules leaflike, lanceolate-attenuate.

Flowering shoot long, surrounded at its base by short scales ashy with silky pubescence, angular, green, nearly glabrous; prickles few, short, weak, from an enlarged base, slender, declining, yellow tinged with purple. Leaves ternate, pilose on both sides but chiefly beneath; leaflets nearly equal, ovate, acute, deeply and doubly serrate, lower ones often strongly lobed on the outer edge below; petioles with very few slender declining prickles; midrib usually unarmed or with very minute prickles. Stipules linear-lanceolate. Panicle short, leafy below, pilose; the upper part and pedicels tomentose and pilose and with a few short sunken setæ or subsessile glands; prickles short, declining, slender, yellow; branches short, ascending, few-flowered, corymbose; bracts trifid with narrow lanceolate segments. Sepals ovate acuminate, woolly on both sides, whitish within, rather green and pilose externally, reflexed loosely from the fruit. Petals shortly ovate, clawed. Primordial fruit apparently hardly more than hemispherical. The flowers and fruit require more careful examination.

In the wood above Cramond Bridge on the Linlithgowshire side of the river; and in a wood just below the road from Kenmore to Acharn, Perthshire.

This bramble was noticed in my 'Synopsis of Rubi' (p. 10. Obs. 2) as a probable form of *R. Salteri*, but I have long been convinced that it is quite distinct from that species. It is a

large straggling plant with strong but usually prostrate stems. The thin, singularly broad, and angular leaves, and the deeply furrowed stem would perhaps be in themselves sufficient to distinguish it from the other "Nitidi."

4. ***R. imbricatus***, Hort.

Mr. Hort has published a full description of this plant (Ann. Nat. Hist. Ser. 2. vii. 374), and it is therefore unnecessary to notice it further in this place.

5. ***R. mucronatus*** (Blox.); *caule* arcuato *subtereti* patenti-piloso, *aculeis* paucis *parvis tenuibus* conicis basi dilatatis rectis subpatentibus, foliis 5-natis utrinque viridibus rugosis et pilosis *argute dentato-serratis, foliolo terminali* late obovato *abrupte cuspidato* basi cordato, paniculæ angustæ foliosæ laxæ pilosæ tomentosæ setosæ ramis longis 1–3-floris et aculeis paucis tenuibus declinatis, sepalis longe cuspidatis hirtis tomentosis setosis a fructu laxe reflexis.

R. mucronatus, *Blox. in Kirby's Fl. Leicest.* 43; *Bab. Man.* ed. 3. 97.
R. sylvaticus, *Bab. Syn. Rub.* 16 (excl. var. β).
R. vulgaris (in part), *Leight. Fl. Shrop.* 231.

Stem arched, nearly round, slightly angular with flat sides towards the end, densely hairy near the base but less so towards the end; hairs patent, not clustered; aciculi and setæ few or none; subsessile glands few; prickles chiefly on the angles of the stem, few, usually small, slender, conical from an enlarged base, patent or very slightly declining. Leaves quinate, rather thick, green rough and pilose on both sides, hairs more numerous on the under side, finely dentate-serrate; petiole midrib and primary veins yellow or reddish beneath, with a few small deflexed prickles; lower pair of leaflets shortly stalked, obovate-oblong, cuspidate; intermediate pair larger, stalked, obovate, abruptly cuspidate; terminal leaflet with a rather long stalk, broadly obovate with a cordate base, abruptly cuspidate. Stipules linear-lanceolate.

Flowering shoot long, with long fuscous scales at its base, slightly angular, green but tinged with purple, hairy; prickles few, generally very small and short, yellow, sometimes long, straight and declining but slender, their base enlarged and compressed. Leaves ternate or quinate, nearly equally hairy on both sides, rather paler beneath; leaflets of the ternate leaves nearly equal, oblong or obovate, finely serrate, lower pair often lobed externally; on the quinate leaves the lower pair of leaflets is small and oblong, intermediate pair and terminal leaflet broadly obovate and cuspidate. Petioles and midribs with few slender declining prickles. Stipules linear-lanceolate. Panicle narrow, very lax, leafy except at the top, hairy and tomentose, often with

many setæ and aciculi; branches mostly axillary, ascending, shorter than the leaves, bearing a corymb of 1–3 long-stalked flowers; summit corymbose; terminal flower shortly stalked. Sepals ovate with a long subulate or linear point, hairy tomentose setose and greenish with a narrow margin of white tomentum externally, whitely tomentose but purple at the base within, loosely reflexed from the fruit. Petals oblong, narrowed at both ends but especially below. Primordial fruit small, hemispherical.

In woods and hedges. Twycross, Leicestershire; and Hartshill Wood, Warwickshire, *Rev. A. Bloxam.* Shawbury Heath, Salop, *Rev. W. A. Leighton.* Islay and Loch Eil in Scotland.

This plant has long been confused with *R. villicaulis,* and was included with it and *R. calvatus* under the name of *R. sylvaticus* in my 'Synopsis.' It is believed that the characters given above will always distinguish it from them. In the shape of its leaves and its very loose panicle with singularly long-stalked flowers, it closely resembles *R. Lingua,* as represented in the 'Rubi Germanici,' but the armature of its stem is very different.

6. ***R. calvatus*** (Blox.); ***caule*** **arcuato anguloso *sulcato* patenti-piloso, aculeis crebris tenuibus compressis basi paululum dilatatis rectis subpatentibus, foliis 5-natis tenuibus utrinque viridibus in venis subtus pilosis grosse dentato-serratis, foliolo terminali ovato-acuminato basi cordato, paniculæ longæ foliosæ laxæ hirtæ brevi-setosæ ramis subracemosis et aculeis crebris longis tenuibus declinatis, sepalis longe cuspidatis hirtis tomentosis setosis a fructu laxe reflexis.**

R. calvatus, *Blox. in Kirby's Fl. Leicestr.* 42; *Bab. Man.* ed. 3. 97.
R. sylvaticus, *Blox. MS.*

Stem arched, angular, furrowed, very slightly hairy, of a bright shining red when exposed, ultimately becoming quite glabrous; hairs patent, not clustered; aciculi and setæ very few; subsessile glands rather numerous; prickles less strictly confined to the angles of the stem than in its allies, many, slender, compressed, slightly enlarged at the base, very slightly declining. Leaves quinate, thin, green on both sides, glabrous above, shortly pilose on the veins and rough beneath, coarsely and doubly dentate or dentate-serrate; petiole and midrib coloured like the stem, with rather many long slender large-based declining or deflexed prickles; midrib with smaller prickles; lower pair of leaflets stalked, oblong, acute; intermediate pair stalked, obovate, subcuspidate, a little cordate at the base; terminal leaflet with a rather long stalk roundly oblong or slightly obovate, subcuspidate, cordate at the base. Stipules linear-lanceolate.

Flowering shoot long, rather angular, green, hairy; prickles many, rather long and slender, lengthening gradually from the

base of the shoot to the panicle, purplish yellow, declining, their base enlarged and compressed. Leaves ternate or quinate, a little pilose above, scarcely paler but much more pilose beneath, doubly dentate; lower leaflets oval cuspidate, shortly stalked; intermediate and terminal leaflets obovate cuspidate; on the ternate leaves the leaflets are nearly equal, broader and rounder, the lower pair being lobed on the external edge below. Petioles and midribs with many strong compressed but often rather small hooked prickles. Stipules linear-lanceolate. Panicle long, leafy often quite to the top, lax, hairy, scarcely tomentose, with very short setæ hidden amongst the hairs; rachis wavy (*i. e.* forming an angle at the origin of each leaf); branches mostly axillary, ascending, shorter than their leaves, racemose-corymbose; terminal flower of the panicle nearly sessile, the others shortly stalked. Sepals oblong, with a long narrow leaflike point, greenish, hairy, tomentose, setose, with a few aciculi, whiter within, loosely reflexed from the fruit. Petals oblong, clawed. I have not seen the fresh fruit which seems to be small.

Woods and hedges. Near Twycross on the Appleby road; near Ashby de la Zouch; and between Loughborough and Wymesmold; all in Leicestershire, *Rev. A. Bloxam.* Almond Park near Shrewsbury, *Rev. W. A. Leighton.*

This species was long considered by Mr. Bloxam as the true *R. sylvaticus* (W. & N.), but the plant of those authors seems probably to be a state of *R. villicaulis.* He has therefore given a new name to this species, derived from its barren stem becoming as it were bald at an early period. It does not much resemble *R. villicaulis* either in appearance or characters, and its true position in the genus is perhaps still to be decided.

XII.—*Observations on the Affinities of the* Olacaceæ. By John Miers, Esq., F.R.S., F.L.S.

[Continued from vol. viii. p. 184.]

Before proceeding further, I will here correct an error inadvertently made in regard to the relations of the *Humiriaceæ* (*ante,* vol. viii. p. 165), which was not noticed till after the preceding "Remarks on the Affinities of the *Olacaceæ*" were printed: in stating there that "the *Humiriaceæ* present a more manifest affinity with the *Symplocaceæ,*" it should have been said, with the *Styraceæ.* This renders it necessary that I should explain the reasons upon which such an opinion is founded. The structure of the ovarium of *Humirium* will be seen to be very similar to that I have described as existing in the *Styraceæ* (*loc. cit.* p. 163), with this difference, that the junction of the partitions

between the cells, at the axis, is almost complete, with the exception of a small portion at the summit, and this is only distinguishable under careful examination: the suspension of the ovules is from a short and free central placenta that rises above the absolute union of the dissepiments, in the very top of the ovarium, and the partitions about this spot, though they all converge as far as, and even touch the central placentary column, are yet really free from it. Although the five cells are here completely established throughout the entire length of the ovarium, still for a very short distance at the apex, there exists a communication between the cells, through the almost imperceptible chinks existing around the margins of such apical portions of the dissepiments as are really disconnected with, although touching the placentary column. The definition of Ad. Jussieu* of "loculis ad apicem inter se perviis," though quite true, is not a correct expression of the structure of the ovarium of *Humirium*. This offers much support to the views of Mr. Bentham in regard to the affinity of the *Humiriaceæ* with the *Olacaceæ*, but in other respects there seems little relation between the two families; for if in the ovarium of *Humirium*, the confluence of the dissepiments had been completed about the central placentary column to the very summit, the position of the *Humiriaceæ* in the system would have been close to the *Aquifoliaceæ*. From the structure of the ovarium and other characters, the conclusion now appears to me irresistible, that wherever the *Styraceæ* may be stationed in any natural arrangement, the *Humiriaceæ* must be placed in contiguity with them. The *Humiriaceæ* will therefore form one of those osculant relations, existing everywhere in nature, which can only be represented by the circular system, and never by any linear arrangement; in the former method the *Cionospermæ* would touch the *Dryades*, through *Humirium*, while in the linear system their location will fall to a distance. The position of the *Humiriaceæ* has never been satisfactorily determined: Von Martius, who first suggested the order in 1826, considered it allied to *Meliaceæ*, though doubtfully: Jussieu, in entertaining the same view, had similar misgivings in regard to this affinity. Dr. Lindley, in his 'Introduction to Botany,' held them more nearly related to the *Aurantiaceæ*, and Endlicher placed them at the head of a class called *Hesperides*, in association with the *Meliaceæ*, *Aurantiaceæ*, &c. Meissner stationed them also in the *Hesperides* of Endlicher, adding at the same time to this class, the *Olacaceæ*; and finally, Dr. Lindley in his 'Vegetable Kingdom' renounces his former views, and fixes them in a most singular association with the *Ericaceæ*, *Epacridaceæ*, *Monotropaceæ*, &c. Mr. Bentham

* Flor. Bras. Merid. A. St. Hilaire, vol. ii. p. 88.

(Linn. Trans. xviii. p. 682) considered "that among dichlamydeous plants, they come nearest to the *Olacineæ;*" but in this conclusion, as I stated before, he had probably in view his tribe *Icacineæ*, where in *Pogopetalum* there is sometimes a similar large fleshy connective, forming a conspicuous appendage much exceeding the length of the anthers, and it has also an ovarium of several cells with two ovules suspended from near the summit. In *Stemonurus* we find similar glandular cilia upon the filaments. In *Ptychopetalum* we have double the ordinary number of stamens, and in several genera of the same tribe, we perceive a hypogynous cup, with ten free lobes, investing the base of the ovarium. They resemble the *Icacinaceæ* also much in habit, having similar coriaceous exstipulate leaves, and terminal or axile inflorescence of small crowded flowers, each flower being supported on an articulated pedicel. Notwithstanding these distant indications, the real affinity of the *Humiriaceæ* appears to me to be nearest the *Styraceæ*.

While speaking of the latter family, I will offer a passing observation upon the anomalous genus *Diclidanthera*, placed doubtfully by Von Martius in *Ebenaceæ* or *Styraceæ*, by Lindley in *Styraceæ*, by Don in *Ebenaceæ*, and by Endlicher in *Styraceæ*. Prof. A. DeCandolle in his 'Prodromus' (vol. viii. p. 245) has given several reasons why it should be excluded from the last-mentioned order, but has not assigned to it any other position, and since then no other botanist has ventured to indictae its true locality in the system. I shall be able to demonstrate that its corolla is not gamopetalous, as generally stated; or at least that its petals are easily separable from each other, being only slightly agglutinated together by the feeble adhesion of the filaments to them. In its habit, its stipular alternate leaves, the linear form of its petals, their mode of æstivation, the stamens always double the number of the petals, the valvular and hinge-like dehiscence of its anthers, the suspension of a single ovule from the summit of each cell of its ovarium, the form and direction of the embryo with large foliaceous cotyledons in fleshy albumen, *Diclidanthera* will be seen to approximate closely to the *Hamamelidaceæ*, from which family it differs only in some slight characters, principally in the absence of the fleshy hypogynous disk that in *Hamamelis* and its congeners serves to agglutinate the base of the ovarium with the lower portion of the tube of the calyx, and which thus renders it semi-inferior.

Whether for this reason, it will form the type of a distinct Order, is a point to be determined when the family of the *Hamamelidaceæ* has been better investigated; but its proximity is certainly here, and in the meanwhile it may be desirable to place it in a separate tribe of that order.

I shall also be able to add some new evidence confirmatory of the observations of Dr. Arnott relative to the structure of *Grubbia* (Hook. Journ. Bot. iii. 266); its alliance however appears to me nearer to the *Hamamelidaceæ* than the *Bruniaceæ*; and the tribe of the *Ophiriæ* including *Grubbia* and *Ophiria* (*Strobilocarpus*) may well form a sectional division of that order, the limits of which will require some modification to include this and the *Diclidanthereæ* as new and distinct tribes.

The structure observed in *Humirium* confirms what I urged in regard to the nature of a stipitate torus (*loc. cit.* p. 176), and of that of the cupuliform disk so frequently alluded to in former pages. We there perceive an ovarium perfectly free and supported on a distinct gynophorus: this is surrounded at its base by a conspicuous cupuliform ring, toothed on its margin, but perfectly free, on both surfaces, down to the base: the ovarium is hairy in all parts, except in the basal portion inclosed within that cup, but not the slightest adhesion exists, either with its glabrous portion or with the gynophorus. Outside of this hypogynous cup is seen another cupshaped ring, serving to support the stamens, which in *H. floribundum* is entire, smooth, and fleshy outside, and supports the many series of filaments upon its margin as well as upon the whole of its inner face, forming thus an annular ring, free both from the hypogynous cup and the petals. Here therefore we perceive the gynophorus, cupuliform disk, staminiferous cup, petals, and sepals, each a distinct development, and each free to the base, but all springing from a fleshy torus which is simply an expansion of the apex of the pedicel. The torus, therefore, as an organ well marked in many of the *Thalamifloræ*, must not be confounded with any of the developments which it serves to support*.

Many of the inferences drawn from the numerous facts indicated in "the Remarks on the Affinities of the Olacaceæ" (*loc. cit.*) are so much at variance with long-established opinions, that I cannot expect they will at first be favourably entertained. Experience has shown, when conclusions upon erroneous grounds have once been made by high authority, and these confirmed by every subsequent author, that nothing short of actual demonstration, and that of the most positive character, can establish other and more correct inferences. In the "Remarks" alluded to, considerable doubt has been thrown on the deductions of some of the most eminent botanists,—men celebrated for the general accuracy of their observations, and for the soundness of their views regarding botanical affinities: I should therefore incur the

* See many excellent remarks, all tending to the same conclusions, in two chapters on the Disk and Floral Receptacle, in Aug. St. Hilaire's 'Leçons de Botanique,' p. 455–466.

charge of temerity in making the several bold statements there offered, unless I was prepared to give proof of all I had advanced: a report of my observations upon the several genera of the *Olaceæ, Santalaceæ, Aquifoliaceæ, Loranthaceæ, Styraceæ*, &c., will consequently be offered in succession, and the results of these researches will at the same time be demonstrated by analytical drawings.

BIBLIOGRAPHICAL NOTICES.

Narrative of the Voyage of H.M.S. Rattlesnake, during the years 1846–50. By John MacGillivray, F.R.G.S., Naturalist to the Expedition. 2 Vols. 8vo. London: T. and W. Boone, 1852.

Those of our readers who possess a tolerably good map of Australia and Torres' Straits will be readily able to comprehend the purpose of the Voyage of H.M.S. Rattlesnake. We need hardly inform them that the course of vessels bound from Sydney for the East Indies lies northward and westward through Torres' Straits. If that part of the Pacific which washes the eastern shores of New Holland were like most seas, free from rocks and reefs within sight of land, the problem of the mariner would be simple enough; but, unfortunately, it is not so. For a distance of from thirty to a hundred miles, a maze of islands, reefs and shoals stretches from the coast and forms as it were its advanced defences, terminating suddenly in the precipitous wall of the Barrier Reef, which has to front the unbroken force of the waves of the great South Sea.

The navigator then may do one of two things: either he may make his way through the labyrinth inside this Barrier Reef, or he may commit himself to the unsheltered and fathomless sea outside it, trusting to the accuracy of his observations for latitude to hit and make his way through, one of its numerous openings.

Each of these courses had its great dangers and difficulties. The former, notwithstanding the demonstration of its practicability by Capt. King, required a much more elaborate survey to be either safe or convenient for merchant vessels and steamers. For the latter, everything had been done that could be done, so far as an accurate and careful marking out of the best passages through the reef was concerned, by Capt. Blackwood and his officers in the 'Fly.' Supposing, however, that in consequence of thick weather or the like, a vessel missed the Raine's Islet passage, she would become involved in the Coral Sea, which lies between the Louisiade Archipelago on the east, New Guinea on the north, and Australia on the west;—an unsurveyed and almost unexamined district, which there was every reason for believing to be full of hidden dangers, and yet which must be traversed in order to reach Bligh's Entrance (or the northern termination of the Barrier Reef), round which lay the only access to Torres' Straits.

The hydrographic duties which the 'Rattlesnake' was commis-

sioned to perform bore reference to these two points of difficulty. And she returned with her mission completed as regards the first, by the survey of the "Inner Route:" as regards the second, by that of so much of the Louisiade Archipelago, the South Coast of New Guinea and of the Coral Sea, as will henceforth enable vessels to travel there in safety.

It is melancholy to reflect that the commander of the expedition, Captain Owen Stanley, the eldest son of the late lamented Bishop of Norwich, known to all as a sedulous cultivator of natural science, lived only to perform the task which had been assigned to him,—not to reap the honours and rewards which he had won, nor by his personal influence to secure to his fellow-labourers that recognition and assistance from their common superiors which their work had fairly earned,—an object which to him, we cannot doubt, would have been as sacred as his own advancement.

As the 'Rattlesnake' was about to visit almost the last corner of the world, accessible by sea, to which Europeans had not penetrated, and therefore was likely to be in the midst of forms of animal and vegetable life of a new and interesting kind, she was provided with a naturalist in the person of Mr. MacGillivray, the able author of the work before us. The expedition, in this respect, has been very fortunate; for whether we regard the extensive and carefully preserved collections which have been sent home by that gentleman—collections, we are informed, on very high authority, equal in value to any that have ever been made in any expedition—or the terse and manly simplicity of the narrative of the Voyage, so different from the blatant platitudes and "middy's-grave" sentimentalities of some on which we could lay our hands, and reminding us more of the close observation, concise expression and occasional quiet humour of old Dampier, we cannot but think that the interests of natural science have been well cared for.

More incident interesting to the general reader occurs in this narrative than falls to the lot of most travellers in these prosaic times, when a circumnavigatory voyage is by no means a thing to boast about—rather a "slow" affair in fact than otherwise.

We find Robinson Crusoeish accounts of people to whom iron was valueless, who looked upon a white face as a clever though very disagreeable piece of painting, and held guns to be vessels for the safe conveyance of water; stories of men who delighted in cultivating heads of hair some two feet in diameter with combs of proportionable size,—until one almost wishes that the Rattlesnake's commander had followed Torres's quaint proceeding and "caught in all this land twenty persons of different nations, that with them we might be able to give a better account to your majesty."—Vol. i. p. 170.

Then it was the good fortune of the expedition to rescue from a condition of misery, an Englishwoman who had been wrecked and had spent some years among the Australian natives, a people whose notions of the *convenances* of society, according to our author, would not seem to make a prolonged stay among them either agreeable or improving. Take for instance the following anecdote. We must

premise that "Paida" is the name of Mr. MacGillivray's particular friend or "cotaig," and apparently a good enough sort of man in general:—

"One morning, at Cape York, Paida did not keep his appointment with me as usual; on making inquiry I found that he had been squabbling with one of his wives a few minutes before, about some trifle, and had speared her through the hip and groin. On expressing my disapproval of what he had done, adding that white men never acted in that manner, he turned it off by jocularly observing that although *I* had only one wife he had two, and could easily spare one of them."—Vol. ii. p. 10.

Much very valuable information as to the customs, language, &c., of the Australian natives was obtained from Gi'om (the native name conferred on the white woman), which could hardly have been procured in any other way. And we regret to be obliged to add, that this information does not at all increase our aspirations after the period when

"wild in woods the noble savage ran."

Man without culture seems to descend, morally speaking, far below the level of the beast; and for filth, cruelty, greediness and cunning, it would be hard to find the equal of the Australian savage among the Vertebrata. The formal details with regard to their character, given by the author in the second volume and elsewhere, are fully borne out, incidentally, by the painful story of poor Kennedy's expedition (vol. ii. p. 117 *et seq.*), one of the saddest and most touching histories, we may remark, which we have for a long time perused.

Mr. Kennedy had distinguished himself in the employment of the Colonial Government of New South Wales, both as Sir Thomas Mitchell's second in command and as an independent explorer. A young man, tall and slight, but wiry and muscular as a race-horse, his physical conformation seemed to fit him for the fatigues of an exploring expedition, as much as his energy and ability, combined with a most amiable disposition, qualified him to command it. Success, however, was not to be his lot.

Those who would follow him from misfortune to misfortune, up to the cowardly attack by the Yagalles, in which his life was sacrificed when he was almost within sight of his goal, must turn to Mr. MacGillivray's work. We only quote the following passage from the journal of one of the survivors as an illustration of native character:—

"About sixty natives came to the camp this morning, well armed with spears, and pieces of fish, which they held up to us to entice us to come to them. We took no notice, however, of their invitations, but, preparing our fire-arms, we turned out. They were now closing round us in all directions, many of them with their spears in their throwing-sticks ready for use,—*pointing them to their own necks and sides, and showing us by their postures how we should writhe with pain when they struck us.* Then they would change their tactics, and again endeavour to persuade us that they meant us no harm, but they would not lay down their spears............After

keeping us standing about an hour, eleven spears were thrown at us. Three of my party then fired, slightly wounding one of them, when they all immediately ran away as fast as they could." Dr. Latham may be right in supposing these people to have migrated from Timor, but such fiendish malignity would almost lead us to think them to be our left-handed brethren sprung from Lilis, Adam's first wife, who bore him all the devils.

The inhabitants of New Guinea and of the Louisiade Archipelago afford a very pleasing contrast to these degraded wretches. Fierce indeed these people are, and apt to carry out the impulse of the moment by the strong hand whenever they are sufficiently powerful, or think themselves so, as was seen in the unfortunate affray with the 'Rattlesnake's' boats (vol. i. p. 234); but still they show evidence of a much higher state of civilization, in their homes, their canoes, their cultivation of the ground, their dress, and all their social habits.

"We had no means of forming a judgement regarding the condition of the women in a social state, but they appeared to be treated by the men as equals, and to exercise considerable influence over them. On all occasions they were the loudest talkers, and seemed to act from a perfect right to have everything their own way........The circumstance of children being daily brought off by their fathers to look at the ship and the strange things there, indicated a considerable degree of parental affection."—Vol. i. p. 271.

A great deal of zoological and botanical information is scattered through these volumes, but an especial value is given to them in this respect by the Appendices, which include disquisitions on the vocabularies collected, by Dr. Latham; on the Polyzoa and Sertulariadæ, by Mr. Busk; on the Mollusca by Prof. E. Forbes, and on the Crustacea and some Insects by Mr. Adam White, besides the meteorological and magnetic observations of Lieut. Dayman. We shall probably return to this portion of the work in one of our next numbers.

It is rumoured that Mr. MacGillivray is to accompany Capt. Denham's projected expedition to the Feejee Islands, as naturalist. If it be so, we congratulate ourselves and our readers on the prospect of another work as readable and instructive as that which we have just brought under their notice.

A finer field for the naturalist could hardly be selected. We wish our author God speed; and when he comes back laden with the '*spolia opima*,' may we be here to see.

The Geology and Fossils of the Tertiary and Cretaceous Formations of Sussex. By Frederick Dixon, F.G.S. London, 1850: Longman and Co. Royal 4to. 44 plates, pp. 422.

The county of Sussex has been fortunate in the illustrations of its geologic history, and that executed by two members of the medical profession, who, amidst their active and arduous duties, have been enabled to collect, and, aided by their scientific acquirements, to examine and describe those fossil organisms, so interesting as revealing the history of the past conditions and changes of life on our globe.

The work by Dr. Mantell on 'The Fossils of the South Downs,'

published more than thirty years since, may certainly be considered as the first provincial work on the subject which combined descriptive geology with illustrations of fossil remains, for the earlier works of Martin* and Morton†, although valuable, were of a different character.

The appearance of Dr. Mantell's work in 1822 excited much interest, and certainly stimulated and promoted inquiry at the time both locally and generally; nor has its value materially decreased even at the present day. During the period since the publication of Dr. Mantell's valuable work, many interesting facts have been discovered by himself and others, and our knowledge of the fossil contents of the Chalk formation has been materially extended by the numerous specimens gathered together, especially of late years, in various private collections, among the first and most interesting of which may be considered that formed by the lamented author of the present volume. Having made so many important additions both of rare and new species, Mr. Dixon proposed to lay illustrations of them before the scientific public, and had nearly accomplished the arduous task, when he was prematurely removed from the scene of his labours, to the deep regret of those friends to whom he was endeared by his amiable and liberal character. He was no niggard, parsimoniously hoarding the rich treasures gathered from among the ancient temples of nature, but liberally placing them at the disposal of those who could fully appreciate their value, and fortunately having amongst his personal friends those who, having always searched nature with truthfulness and assiduity, rendered, by their kindly co-operation, this work one of great importance and value to the student of palæontology.

First among these may be mentioned Prof. Owen, without whose kind and prompt assistance the completion of the volume might have been indefinitely delayed, and the publication of which was materially facilitated by the liberality of Mrs. Thwaytes, of Charman Dean near Worthing, whose name, as Prof. Owen remarks, "will ever be honourably associated with those of other munificent promoters of science in this country, and by the geologist, who may find in its pages, or its beautiful and accurate plates, a helping guide in the course of his investigations."

The work does not profess to give a general geological history of the county; otherwise another volume would have been required, had the author entered upon the description of the Lower Cretaceous formation and the Wealden; for these, however, the previous excellent researches and observations of Dr. Fitton and Dr. Mantell may be advantageously consulted. The reader, however, will find some interesting and useful information in the chapters on the Geological View of Selsey and Bracklesham Bay, the Eocene Formations of the District, the Geological Position of Bognor and the Sussex Coast to Brighton, including Worthing and its vicinity, and some interesting notes on the Chalk formation.

No one who consults this volume can fail to perceive the energy,

* Petrificata Derbiensis, 1809.

† The Natural History of Northamptonshire, 1712.

intelligence, devotion, and, we know, self-sacrifice, by which the lamented author enriched his collection, so as to render it available for the purpose of science; nor has he forgotten gratefully to acknowledge the assistance of numerous friends who have contributed specimens for illustration in the work. To the archæologist as well as the geologist this volume is acceptable, as in it he will find notices, with illustrative woodcuts, of various interesting British and Roman coins, vessels and implements found near Worthing; and as characteristic of his pursuit, although apparently out of place in a geological treatise, we feel that "a local geologist, whose immediate researches were into the history of the remoter antiquities of his district, could hardly fail to have his interest excited by the analogous evidence of the past history of his own race." In fact, as ably shown by Dr. Mantell in a paper read before the Archæological Association at Oxford, there is an intimate connection between archæology and geology; and the entombment of man and his works at different portions of the historical period, indicative of changes to which the human race has been subjected in the same region, are but the faint counterparts of those mightier revolutions by which whole dynasties of organized beings have been successively changed—those lost tribes of plants and animals which once inhabited the globe. As bearing on this subject we extract the following remarks relative to an interesting ornamented vase found in cutting the railroad near Worthing in 1845:—

"Imported red Samian pottery with stags and animals has been occasionally found in England; but this curious relic I think, from its material and manufacture, was made in this country, and is of double interest; first, as a specimen of art, and secondly, as representing animals almost extinct, which were formerly common in England, as geological evidence fully corroborates, and showing besides how the red deer, like the ox, goat, wolf, and other animals, has been scattered and destroyed by the hand of civilization."

It must however be admitted that the great interest of the work depends upon the valuable contributions by the following eminent naturalists:—Prof. Owen the *Reptiles*, Prof. E. Forbes the *Echinoderms*, Mr. Lonsdale the *Corals*, Mr. Bell the *Crustaceans*, Mr. J. Sowerby the *Mollusks* and *Foraminiferæ*; and Sir P. Egerton kindly assisted in revising the author's notes on the extinct fishes of the Chalk, and in describing the plates illustrative of that class of the cretaceous fossils.

These descriptions are accompanied by forty-four beautifully executed plates, by artists whose names are a sufficient guarantee of their accuracy, J. de C. Sowerby, Dinkel, Erxleben, and Aldous. A useful list of the tertiary and cretaceous fossils, with references, synonyms, and localities, will be found in the volume.

Among the eocene reptiles described by Prof. Owen are two new species of serpents, *Palæophis typhæus* and *P. porcatus*, Owen, two new species of *Chelone*, *C. trigoniceps* and *C. declivis*, Owen, and some fine remains are noticed which prove the former existence in England, during the early tertiary period, of a Gavial, *G. Dixoni*: "this genus

is now represented by one or two species peculiar to the great rivers of India, more especially the Ganges; and the fossil differs from both the *Gavialis gangeticus*, Auct., and from the perhaps nominal *G. tenuirostris*, Cuv., in the form and relative size of the teeth."

In the interesting observations on the cretaceous fossil reptiles, Prof. Owen describes a new species of *Mososaurus, M. gracilis,* and one of *Plesiosaurus, P. Bernardi,* and also satisfactorily establishes two genera of lizards, *Coniasaurus* and *Dolichosaurus,* with procœlian cup-and-ball vertebræ, by the recent discovery of portions of the jaws and teeth: of one of these which is distinct from the *Raphiosaurus*, Prof. Owen remarks, "There is no existing species of the Iguanian or other herbivorous family, nor any of the pleurodont saurians with which the present chalk fossil is identical, nor can I refer it to any of the established genera of *Lacertia*: the absence of the cranium and bones of the extremities does not allow of any closer comparison with the Monitors, Iguanas, or Scinks; but the characters of the teeth justify the consideration of the fossil as the type of a hitherto undescribed genus and species, which I therefore propose to call *Coniasaurus crassidens*, or the thick-toothed lizard of the chalk formation." Of the other, a beautiful specimen, comprising the head and anterior thirty-six vertebræ, in the collection of Mrs. Smith, and a chain of posterior abdominal and sacral vertebræ belonging to Sir P. Egerton, which there is good reason to suppose belonged to the same individual, Prof. Owen gives a detailed description, and shows in conclusion, "That all the general characters of the Lacertian type of the vertebrate skeleton are presented by the *Dolichosaurus*; they are most modified in the cervical region, where the Ophidian type is rather followed, in the number and size of the vertebræ, and in the size and shape of the ribs; a less decided approach, but one still indicating an affinity to the Ophidians, is made by the unusual length of the slender trunk, which includes, from the skull to the sacrum, not fewer than fifty-seven vertebræ, and is not less than 18 inches in length. The smallness of the head accords with the long and slender proportions of the neck, and must have added to the snake-like appearance of this early example of procœlian lizard. But the complete and typically Lacertian organization of the scapular and pelvic arches, and of their locomotive appendages, proves that the *Dolichosaurus* was more strictly a lacertine Saurian than the existing genera, *Pseudopus, Bipes,* and *Ophisaurus,* which effect the transition from the lizards to the snakes or typical Ophidian reptiles."

The Fishes of the Chalk are interesting, inasmuch as here first appear forms belonging to those two orders of fishes, the Cycloid and Ctenoid, which attain their maximum development in the present seas, and associated with the Placoid and Ganoid orders, which are characteristic of the older formations. Of the Placoid are two new genera, *Aulodus* and *Plethodus,* and several new species belonging to the genera *Ptychodus, Acrodus, Corax,* and *Oxyrhina*; but the most interesting are the remains of a Cestracion, as—

"The discovery of a species of true *Cestracion* in the Chalk is an event of much interest, since this genus has hitherto only been known

from the recent *Cestracion Philippi*, or Port Jackson shark, a fish most valuable to palæontologists as being the only existing type of the family Cestraciontidæ, so extensively distributed through our fossiliferous strata, from the Silurian to the Chalk both inclusive."

Of the Ganoid order are the new genera *Pomognathus*, Ag., proposed by Agassiz, from the lower jaw extending so far back towards the opercular bones; *Prionolepis*, Egerton, allied to *Aspidorhynchus*, but differing in the arrangement and articulation of the scales; and *Phacodus*, Dixon, so named from the kidney-bean-shaped character of the teeth.

In the Ctenoid order are briefly noticed *Berycopsis* and *Homonotus*, Ag., new genera allied to *Beryx*, and *Stenostoma*, Ag., allied to *Rhacolepis*.

In the Cycloid order are the new genera *Pachyrhizodus* and *Tomognathus*. The affinities of the latter genus are unknown; the only portions discovered having been jaws and portions of the cranium.

The elaborate descriptions of the Corals by Mr. Lonsdale furnish much valuable matter in the detailed notes accompanying each species and their comparison with allied forms. Eight species of eocene Anthozoa are described. Among the cretaceous Anthozoa five new genera are described, viz. *Monocarya, Diblasus, Axogaster, Epiphaxum*, and *Spinopora*. Among the Bryozoa Mr. Lonsdale includes six new genera, viz. *Desmeopora, Petalopora, Holostoma, Siphoniotyphlus, Homœosolen*, and *Atagma*, besides some new species belonging to established genera. By short extracts merely from this important part of the volume, we should not have conveyed to the reader the minute accuracy of description embodying the careful examination of the species noticed; but it points out how cautious our determinations should be in the specific forms of either the Anthozoa or Bryozoa.

Among the fossils of the Chalk formation, the sea-urchins and starfishes are generally considered more interesting, and arrest the attention of the collector; of these many new and beautiful forms are fully illustrated in the work before us. Nor have the Echinodermata been neglected in the researches of the zoologist, many valuable physiological and systematic memoirs having of late appeared in elucidation of their recent history, which has materially assisted the investigation connected with the relations of the existing and extinct forms.

The family Asteriadæ, which until recently was considered to have commenced with the Oolitic period, have, through the labours of Prof. Sedgwick, Mr. Sharpe, and the Geological Survey, been found in strata of Silurian age, both in Westmoreland and North Wales; and what is equally interesting, they are referred to the genus *Uraster*, the members of which, although found in all parts of the world, are more characteristic, by their abundance and predominance, of the approach to the Arctic or Antarctic regions. Prof. E. Forbes, in his valuable and scientific Synopsis of the British Fossil Asteriadæ, published in the 'Memoirs of the Geological Survey,' p. 462, states—

"It is very remarkable that all the true starfishes, hitherto discovered in a fossil state in the sedimentary deposits of the palæozoic oceans, appear to belong to this genus *Uraster*, whilst the majority

of the cretaceous species belong either to *Goniaster* or to genera still more distinctly tropical in character."

The Asteriadæ attained not only their maximum of development at the cretaceous period, but appear, as far as the fossil species are concerned, to have exceeded in number all those hitherto collected and described from the other geological formations. Of the twenty-four species noticed in this work, and the diagnoses of which originally appeared in the 'Memoirs' before cited, seven belong to the genus *Oreaster*, the *O. bulbifera*, Forbes, being the handsomest and most curious, but rarely found well-preserved; fourteen to *Goniaster* (including *Goniodiscus* and *Astrogonium*); two to *Stellaster*; and one, the most beautiful and singular of cretaceous starfishes, is assigned to a new genus *Arthraster* (*A. Dixoni*), which is closely allied to the living genus *Ophiodaster*; "but the ossiculæ of the arms are very compactly articulated together and much fewer in number; their arrangement is also very different: exclusive of the ambulacral ossiculæ, which are unknown, only seven bones enter into the composition of the framework of the arm transversely, and these alternate in such a manner as to form a compact skeleton without conspicuous interstices."

In the other part of the monograph by Prof. Forbes, some new species of sea-urchins are described, as well as notices of those previously known; besides which are two plates illustrative of many very interesting, beautiful, and unique specimens of the cretaceous Crinoidea,—*Marsupites, Pentacrinus*, and *Apiocrinus*: among the figures of the latter, referred to *A. ellipticus*, we quite agree with the describer, that more than one species is certainly included.

In the above notice we have chiefly directed attention to the more important generic novelties contained in this volume, scarcely alluding to the many species indicated as entirely new, or those described by foreign authors, but only recently identified as occurring in the tertiary and cretaceous formations of this country, as well as the additional facts derived from the study of finer specimens of imperfectly known species.

We sincerely hope that this work may obtain a very general circulation, and find its way into many private as well as public libraries; and that the example of the estimable lady, previously mentioned, may stimulate the wealthy supporters of science to possess a volume alike interesting to the geologist and archæologist of the South of England, and to those engaged in the study of the cretaceous and tertiary formations elsewhere. Nor will the intelligent reader, who consults the pages with a view of becoming acquainted with that portion of the earth's history, fail to perceive the higher tendency which the contemplation of the beautiful works of Creation constantly produced in the mind of the author, when he assures those who study natural history in the most extensive sphere, that it is "well calculated to improve our intellectual powers, to stimulate our exertions, and raise our adoration and gratitude to the Supreme Disposer of all things."

A Popular History of British Ferns and the allied Plants. By T. Moore, F.L.S. &c. London, 1851: Reeve and Benham.

As this elegant little work professes to be wholly of a popular character, it does not require much notice in our Journal; we cannot, however, pass it over without a few remarks.

Owing to its objects, the technical characters of the genera and species do not hold at all a prominent place in the book, but both are shortly given. Its most characteristic feature is found in the beautiful coloured plates, from the pencil of Mr. Fitch, the celebrated botanical artist, which seem to be all that can be desired as popular representations of the species, nearly all of which are figured. The mode of cultivating the species, so as to afford interesting objects, is also wisely made a subject of especial attention, and, as far as we can judge, such directions are given as to render success nearly certain. Attention is more especially turned to the growth of ferns in closed glass cases, on the plan recommended by Mr. N. B. Ward.

On the whole, we can recommend the book to those who are ignorant of scientific botany, and yet, as is now not unfrequently the case, admire and desire to grow ferns. We must however remark, that the descriptions, and indeed sometimes other parts of the book, are rather too technical in their language for the class of readers to which it is addressed. In books like this, which do not claim a scientific character, we could wish to see English words used, wherever such can be found, which will convey the meaning with sufficient accuracy, rather than the English forms of the botanical Latin terms. Of course, this is often nearly impossible; but still the cases are not a few in which it might be done. We think also that the author shows an inclination towards the use of those English words which are derived from the Latin, rather than such as are of Saxon origin; this, in a work intended "especially for the young," is a defect, since words of the latter kind are far more easily understood by them and all other partially educated persons.

At the close of the book there is a very valuable tabular statement of the counties of the United Kingdom in which the several species have been observed to be native, and in many cases the exact places are stated. This is the more interesting, as we do not as yet possess any account of the geographical distribution of Ferns which is even nearly so complete. It is to be hoped, however, that the present year will not conclude without the publication of the third volume of Mr. Watson's valuable 'Cybele Britannica,' in which it is probable that the Ferns will be included. We are glad to be able to state that it is already in the press.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

July 9, 1850.—John Gould, Esq., F.R.S., in the Chair.

Description of a new genus of the Family Melaniana, and of many new species of the Genus Melania, chiefly collected by Hugh Cuming, Esq. By Isaac Lea and Henry C. Lea, Philadelphia.

[Continued from p. 70.]

Melania Cumingii. *M. testâ striatâ, turritâ, supernè uno-carinatâ, subcrassâ, tenebroso-fuscâ; spirâ valdè elevatâ; suturis regulariter impressis; anfractibus planulatis, lineis raris impressis; aperturâ magnâ, subtriangulari, intus cærulescente; columellâ retusâ contortâque.*

Hab. Very small streams, island of Siquijor, Philippines.

Length 2·5, diam. ·7 of an inch.

Remarks.—This is a very remarkable species. A single specimen only was sent by Mr. Cuming, and this unfortunately is by no means perfect. There is a good deal of ferruginous matter deposited over the surface, and the apex is so much eroded that the number of whorls cannot be well ascertained, perhaps about nine. The turrited form of the shell is very notable. Immediately under the suture there is an elevated and cordlike line, slightly angular on the superior part. Below this the whorl is slightly impressed. Part of the surface is wrinkled by the transverse striæ decussating longitudinal lines. The aperture is about one-third the length of the shell, and remarkable for its triangular form. The columella is unusually white, which shows in contrast with the dark epidermis. The operculum is large and thick, having its polar point near to the lower border.

Melania dactylus. *M. testâ striatâ, valdè elevatâ, supernè costatâ, crassâ, vel fuscâ vel luteo-corneâ; spirâ valdè elevatâ; suturis impressis; anfractibus duodecim, convexis, lineis crebris elevatis ornatis; costellis verticalibus crebris; aperturâ submagnâ, subrotundatâ, intus vel salmoniâ vel cæruleâ; columellâ incrassatâ, salmoniâ tortâque.*

Hab. Small streams in Guimaras, Mindanao, Luzon and Seyte, Philippines.

Length 3·2, diam. 1 inch.

Remarks.—This is a remarkably fine, large, and protean species. There are about two dozen specimens under examination from various islands of the Philippines. The prevailing character of the surface is striate with decussating costæ on the superior whorls; but some specimens have these costæ enlarged on the lower whorls, instead of their having vanished, as on others. Some again have their costæ rising into a series of pointed tubercles. Under the microscope many numerous minute striæ may be observed to revolve parallel with the coarser ones. Another variety is quite smooth on the upper whorls, with fewer striæ and costæ. This looks like an immature shell. The

aspect of these three varieties is quite different, but I do not consider it safe to separate them into species. The aperture is rather more than one-fourth the length of the shell. The operculum is large, having several revolutions, and the polar point is near to the centre.

Melania crenifera. *M. testâ granulatâ, acuto-conicâ, subfusiformi, subtenui, corneâ; spirâ granulatâ, acuminatâ; suturis irregulariter impressis; anfractibus novem, convexiusculis, ad basim striatis; aperturâ submagnâ, ovatâ, intus albidâ; columellâ albâ tortâque.*

Hab. Small river in Java.

Length ·9, diam. ·4 of an inch.

Remarks.—Three specimens under examination are all nearly covered with granules, a fourth has but few. It is a very symmetrical little species. The aperture is rather more than one-third the length of the shell. No opercula accompanied these specimens.

Melania nana. *M. testâ granulatâ, conicâ, fusiformi, tenui, diaphanâ, vel corneâ vel fuscâ, rufo-maculatâ; spirâ depressâ, granulatâ; anfractibus sex, subplanulatis, ad basim striatis; suturis irregulariter impressis; aperturâ magnâ, ellipticâ, intus vel albidâ vel fuscâ; columellâ tortâ.*

Hab. Mountain streams, isle of Negros, Philippines.

Length ·6, diam. ·3 of an inch.

Remarks.—The colour varies in this species owing to the number of brown spots, which differ much in different specimens. One of those under examination is horn-coloured, with a few distinct brown spots; another is quite dark in consequence of the multiplicity of them. The largest granules are immediately below the suture, and the line there is disposed to be of lighter colour. The aperture is about one-half the length of the shell.

Melania tessellata. *M. testâ granulatâ, elevato-conicâ, crassâ, tenebroso-fuscâ; spirâ elevatâ, crebrè granulatâ; anfractibus planulatis, ad basim striatis; suturis irregulariter impressis; aperturâ parvâ, ellipticâ, constrictâ, crenulatâ, intus tricostatâ, ad basim canaliculatâ; columellâ subrectâ.*

Hab. ——?

Length 1·10, diam. ·4 of an inch.

Remarks.—There is nothing striking in the general appearance of this shell; but in looking into the interior, there will be observed a character which has not been known to exist in any other species—three elevated, revolving ribs, terminating short of the outer lip. The columella is simple, nearly straight, and ends in the angle at the sinus. These remarkable ribs may involve a difference of organic structure of the animal, in which case a new genus would be required for this species. One of the three specimens is entirely white inside, the other two have dark bands. The apex being eroded in them all, the number of whorls cannot be ascertained, probably about nine. The aperture is about one-third the length of the shell. The operculum has its polar point near to the lower margin.

Melania crebrum. *M. testâ cancellatâ, elevato-conicâ, crassâ, tenebroso-castaneâ; spirâ valdè elevatâ; anfractibus decem, convexiusculis, ad basim striis impressis; suturis impressis; aperturâ parvulâ, ovatâ, intus albidâ; ad basim rotundâ; columellâ incurvatâ.*

Hab. Small streams, Guimaras, Philippines.

Length 1·5, diam. ·5 of an inch.

Remarks.—The symmetry of the outline and the extreme regularity of the decussating lines over the whole of the whorls, except at the base, are distinguishing characteristics of this species. The elevated portions between the decussating lines are quadrangular and resemble brickwork. The four specimens submitted are all "dead shells," and are partly decomposed towards the apex. The aperture is rather more than one-fourth the length of the shell.

Melania reticulata. *M. testâ cancellatâ, conicâ, crassâ, pallidâ; spirâ elevatâ; anfractibus septem, planulatis, crassè cancellatis, ad basim striatis; suturis impressis; aperturâ magnâ, trapezoideâ, ad basim angulatâ, intus albâ; columellâ incurvatâ, contortâque.*

Hab. China.

Length 1·8, diam. ·7 of an inch.

Remarks.—This is a very remarkable and distinct species, covered all over, except the lower part of the base whorl, with coarse, somewhat distant decussating striæ, which rise into nodes and form quadrangular areas. Altogether it is a rough Cerithium-looking species. The epidermis is remarkably thin and light-coloured, the upper portion of the spire being quite white in the two specimens under examination. The aperture is more than one-third the length of the shell.

Melania aculeus, Lea. *M. testâ lævi, nonnunquam striatâ vel granulatâ, elongatè subulatâ, crassâ vel subcrassâ, corneâ vel fusco-nigricante; spirâ acuminatâ; suturis linearibus; anfractibus planulatis; aperturâ ovatâ, intus cærulescente; labro expanso.*

Hab. Siquijor, Naga, Cagayan, and others of the Philippines.

Length 2·6, diam. ·7 of an inch.

Remarks.—When this species was described by J. Lea in 1832 (Trans. Am. Phil. Soc.), he had seen but a single specimen, which had neither granules nor striæ. Among the large quantity of this genus taken by Mr. Cuming in his Eastern voyage, were about forty specimens of this singularly protean species. Were there but few, and these as different as many of them are, no one would hesitate to consider them as distinct species. But the large number and extraordinary difference in them enables one, or rather compels one to keep them in a group as curious divergent varieties. When we compare the large smooth variety with the small variety covered with granules, it is difficult to believe that they may have come from a common parent, but the *nuance* is too complete in the series to admit of a doubt.

It was deemed advisable to re-describe this species, so that it might

embrace the various forms which it takes in the specimens now submitted by Mr. Cuming from various localities.

MELANIA DIADEMA. *M. testâ spinosâ, acuminato-ovatâ, transversim lineatâ, subpapyraceâ, diaphanâ, pallio lutescente; spirâ scalariformi, acutâ; suturâ lineatâ; anfractibus octo, supernè angulatis, planis supra et infra; angulo spinis instructo; spinis magnis, crebris, regularibus, brevibus, eversis, aliquando decurrentibus; lineis transversis, minimis, decussatis; anfractu ultimo bullato, ad basim lineato; aperturâ magnâ, ovatâ; columellâ albidâ, incurvâ; epidermide hispidâ.*

Hab. Small streams, isle of Guimaras, Philippines.

Length 1·4, diam. ·8 of an inch.

Remarks.—Differs from *M. amarula* in the thinness of its substance, and regularity and closeness of its spines, which are all bent outwards, at a regular angle.

MELANIA CORNUTA. *M. testâ spinosâ, elongato-ovatâ, crassâ, fuscescente vel viridescente; spirâ exsertâ, scalariformi, apice truncatâ; suturâ lineari; anfractibus medio angulatis, supernè subconcavis; angulo spinis instructo; spinis magnis, brevibus, incurvis, raris, acutis, basi latissimis, distortis, decurrentibus, anticè canaliculatis; anfractu ultimo magno, ad basim transversim striatulo; aperturâ magnâ, ovatâ; columellâ lacteâ.*

Hab. Madagascar.

Length 1·5, diam. ·9 of an inch.

Remarks.—The spines are short, stout, and irregularly bent, presenting the appearance of horns, and distinguishing the shell from *M. amarula*, which it otherwise somewhat resembles.

MELANIA ACANTHICA. *M. testâ spinosâ, ovato-turritâ, varicosâ, transversim lineatâ, subtenui, fuscâ; spirâ elongatâ, conicâ, scalariformi; apice truncatâ; suturâ lineari; anfractibus supernè angulatis, varicibus distortis; angulo spinis instructo; varicibus magnis, regularibus, subobliquis, supernè in spinis productis; spinis longis, tenuibus, irregularibus, extortis; lineis transversis, crebris, parvis, subalternantibus; anfractu ultimo parvo, ad basim lineato; aperturâ ellipticâ, infernè effusâ; labro infernè producto; columellâ parvâ, infernè incrassatâ.*

Hab. Manilla and isle of Negros, Philippines.

Length ·8, diam. ·4 of an inch.

Remarks.—Bears some resemblance to *M. scabra*, Férussac, and *M. bellicosa*, Hinds.

MELANIA ZEYLANICA. *M. testâ lævi, ovatâ, crassâ, nitidâ, albidâ aut virido fuscâ; badio flammulatâ, spirâ brevi, acuminatâ, apice acutâ, aliquando erosâ; suturâ lineari; anfractibus quinque, convexis, ad suturam superiorem impressis, maculis flammulatis aut sagittatis badiis; anfractu ultimo magno, bullato; basi lævi; aperturâ ovato-rotundâ, supernè angulatâ, infernè rotundatâ, intus albidâ; columellâ magnâ, albâ, supernè incrassatâ, infernè curvatâ.*

Hab. Seychelles and Ceylon.

Length ·9, diam. ·6 of an inch.

Remarks.—The markings are very variable, being sometimes oblique, zigzag lines, extending over the whole surface of the whorls, sometimes sagittate or short zigzag spots in transverse series. Indeed some specimens are of a uniform dark green. The last whorl sometimes has two impressed transverse lines. The mouth is nearly two-thirds the length of the shell.

MELANIA POLYGONATA. *M. testâ tuberculatâ, elevato-conicâ, striatâ, crassâ, nigrâ; spirâ elevatâ, conicâ, apice erosâ; suturâ pæne obsoletâ, flexuosâ; anfractibus supernè et infernè striatis; medio angulatis; angulo serie unicâ tuberculorum instructo; tuberculis maximis, transversè angulatis, lævibus; striis transversis raris; anfractu ultimo magno; basi crebrè striatâ; aperturâ supernè valdè acutâ, infernè productâ et effusâ, intus albidâ; columellâ albâ, flexuosâ; operculo parvo, subcentrali.*

Hab. Copan, Central America.

Length 3·5, diam. 1·3 inch.

Remarks.—One of the largest and finest of the *Melaniæ.* The upper whorls are generally covered with a thick, smooth deposit, obliterating the sculpture. On them the tubercles appear to degenerate into elevated costæ. The operculum is much smaller than the mouth. The tubercles and striæ sometimes produce brown marks on the columella and inside the aperture.

MELANIA DENTICULATA. *M. testâ spinosâ, ovato-turritâ, transversim striatâ, denticulatâ, tenui, diaphanâ, ferrugineâ, maculis badiis minutis linearibus; spirâ exsertâ, conicâ, scalariformi, apice acuminatâ; suturâ lineari; anfractibus septem, supernè angulatis, angulo denticulatis; denticulis parvis, acutis, obliquis; striis transversis, parvis, alternantibus, rugosis, maculatis, lineolis longitudinalibus minutissimis decussatis; anfractu ultimo parvo, ad basim striato; aperturâ ovatâ, infernè effusâ; columellâ flexuosâ, tenui.*

Hab. Mountain streams, isle of Negros, Philippines.

Length ·6, diam. ·3 of an inch.

Remarks.—Allied to *M. spinulosa*, Lam., but may be distinguished by its abrupt denticulations.

MELANIA ARMILLATA. *M. testâ cancellatâ, ovato-turritâ, crassiusculâ, graniferâ, viridescenti; spirâ elevatâ, subovatâ, apice acutâ; suturâ parvâ, crenatâ; anfractibus undecim, planatis, propè suturam superiorem angulatis, supernè albidis, costis longitudinalibus obliquis graniferis crebris; granulis rotundatis, albidis; anfractu ultimo supernè compresso, infernè subturgido; basi transversè striatâ; aperturâ ovatâ, supernè acutè angulatâ, infernè rotundatâ et effusâ; labro infernè producto; columellâ infernè angulatâ, supernè rectâ.*

Hab. India.

Length 1·4, diam. ·5 inch.

Remarks.—Immediately below the angle of the whorls there is apt to be a larger series of granules, with a very small one succeeding it.

Melania cochlea. *M. testâ subspinosâ, turritâ, costatâ, striatâ, tenui, fulvâ, maculis badiis; spirâ scalariformi, ovato-acuminatâ, apice acutâ; suturâ lineari; anfractibus decem, infernè subconvexis, supernè angulatis et concavis; costis obliquis, longitudinalibus, anfractuum in angulo elevatis et acutè mucronatis, supernè vix obsoletis; striis transversis, minutis, aliquando obsoletis; anfractu ultimo parvo, ad basim striato; aperturâ ovatâ, supernè acutâ, infernè effusâ.*

Hab. ——?

Length 1, diam. ·4 of an inch.

Remark.—On the last whorl of the only specimen submitted, the costæ are almost obsolete. The striæ are strongest near the sutures, and scarcely visible at the middle of the whorls.

Melania lateritia. *M. testâ cancellatâ, acutè ovatâ, compressâ, crassiusculâ, striatâ, graniferâ, albidâ, virido-fuscâ, rufo fasciatâ aut atrâ; spirâ elevatâ, plerumque scalariformi, apice acutâ aut erosâ; suturâ impressâ, crenatâ; anfractibus decem, planatis, supernè angulatis, supra angulum sæpe albidis; striis transversis crebris graniferis; granulis quadratis, abruptis, planatis, seriebus longitudinalibus positis; anfractu ultimo magno, subcompresso; basi graniferâ; aperturâ ovatâ, supernè acutè angulatâ et sinuatâ, infernè latâ, expansâ et retusâ, internè sæpe fasciatâ; columellâ contortâ; operculo parvo, ovato.*

Hab. Philippines.

Length 1·6, diam. ·7 of an inch.

Var. *α. Anfractibus supernè graniferis, infernè striis transversis impressis; basi vix lævi, striis raris.*

Var. *β. Striis graniferis alternantibus.*

Remarks.—A very variable species as to size, colour and sculpture. The operculum differs much in some individuals in both its shape and apex. This shell bears some resemblance to the *M. granifera*, Lam. Its most remarkable characteristic is its square, flattened granules, bearing some resemblance to brickwork.

Melania modicella. *M. testâ lævi, ovato-conicâ, crassâ, nitidâ, virido-fuscâ; spirâ conicâ, brevi, apice acutâ, sæpe erosâ; suturâ lineari; anfractibus quinque, convexis, rapidè crescentibus, prope suturam superiorem depressis, prope suturam inferiorem striis parvis transversis duabus aut tribus; anfractu ultimo magno, medio striis tribus, basi lævi; aperturâ ovato-rotundâ, supernè subangulatâ, infernè subeffusâ, intus albidâ; labro acuto; columellâ lacteâ, curvatâ; operculo ovato, subcentrali, concentrico.*

Hab. Timor.

Length ·7, diam. ·5 of an inch.

Remarks.—This shell and the *M. zeylanica* may perhaps be taken as the types of a new genus or subgenus. Further investigation with respect to the animal may decide; in the meantime, the name of Rivulina is proposed provisionally. The general outline and operculum are those of the Paludina. In old specimens the peritreme of the mouth is continuous, but there is only a slight depression behind

the columella in place of an umbilicus. The upper whorls are occasionally faintly lined or spotted with brown.

Melania pagoda. *M. testâ spinosâ, turritâ, costatâ, transversim striatâ, tenui, diaphanâ, corneâ, maculis badiis minutis linearibus; spirâ elongatâ, subovatâ, acuminatâ, scalariformi; suturâ lineari; anfractibus decem, supernè angulatis et subconcavis, angulo spinulosis; costulis obliquis longitudinalibus, infernè obsoletis, supernè in spinulas aut denticula eversa productis, in anfractibus superioribus crebrissimis et magnis, inferioribus minoribus rarioribusque; striis transversis, parvis, crebris, alternantibus, maculatis, lineolis longitudinalibus decussatis; anfractu ultimo usque ad basim striato; aperturâ ovatâ, supernè acutâ, infernè effusâ.*

Hab. Isle of Guimaras, Philippines.

Length 1·4, diam. ·6 of an inch.

Remarks.—A beautiful little species, with irregular spines, very strongly marked on the upper whorls, but which sometimes diminish to denticulations on the lower. It can be mistaken for none of its congeners, except perhaps the *M. cochlea.*

July 23.—W. Yarrell, Esq., V.P., in the Chair.

A Monograph of Cyllene, a genus of gasteropodous Mollusca. By Arthur Adams, R.N., F.L.S. etc.

Cyllene, Gray.

Animal unknown. Operculum thin, horny, unguiform, with terminal nucleus and imbricate elements. Shell ovate, volutiform; spire short; suture channeled; aperture oval; columella anteriorly with oblique grooves; outer lip thickened externally, notched in front, grooved within, and subreflected at the margin.

1. Cyllene lyrata, Lamarck.

Buccinum lyratum, *Lamk. Hist. An. s. Vert.* tom. vii. p. 272; *Kiener, Mon. Bucc.* pl. 22. fig. 88.

2. Cyllene Grayi, Reeve.

Cyllene Grayi, *Reeve, Elements of Conch.* pl. 3. fig. 12.

3. Cyllene Owenii, Gray.

Cyllene Owenii, *Gray, MSS. Brit. Mus.*

4. Cyllene pulchella, Adams and Reeve.

Cyllene pulchella, *Adams and Reeve, Zool. of Voy. of H.M.S. Samarang,* tab. 10. fig. 11.

5. Cyllene lugubris, Adams and Reeve.

Cyllene lugubris, *Adams and Reeve, Zool. Voy. Samarang,* tab. 10. fig. 10.

6. Cyllene concinna, Soland. *C. testâ ovato-fusiformi; spirâ productâ, albâ, maculis luteo-fuscis ornatâ, longitudinaliter*

subsulcosâ, transversim totâ striatâ; columellâ anticè obliquè plicatâ; labro extus lævi, incrassato.

Hab. Guinea.

Buccinum concinnum, *Sol.*

7. Cyllene orientalis, A. Adams. *C. testâ ovato-fusiformi, albidâ, maculis luteo-fuscis ornatâ, longitudinaliter plicatâ, transversim striatâ; spirâ prominulâ; columellâ anticè perobliquè sulcatâ, labro intus lævi.*

Hab. Singapore, 6 fathoms, mud; *H. C.* Malacca, 6 fathoms, coarse sand; *H. C.*

8. Cyllene striata, A. Adams. *C. testâ ovatâ, albâ, maculis rufo-fuscis ad suturas pictâ, cingulis duabus maculorum luteo-fuscorum ornatâ, longitudinaliter subplicatâ, transversim totâ striatâ; columellâ anticè obliquè sulcatâ; labro tenui, intus lævi, anticè vix sinuato.*

Hab. Albrokkas Islands, under coral, low water; *Mr. Dring.*

9. Cyllene fuscata, A. Adams. *C. testâ ovatâ, rufo-fuscâ, fasciis transversis obscuris articulatis ornatâ, longitudinaliter plicatâ, plicis numerosis, subconfertis, supernè et infernè transversim valdè striatâ; columellâ anticè valdè corrugato-plicatâ, labro anticè valdè sinuato.*

Hab. W. Africa.

10. Cyllene pallida, A. Adams. *C. testâ ovatâ, albidâ, longitudinaliter subsulcatâ, obscurè nodoso-plicatâ, glabratâ, supernè et infernè transversim striatâ; columellâ anticè plicis obliquis, labro anticè valdè sinuato.*

Hab. West Africa.

11. Cyllene grana, Lamarck.

Buccinum grana, *Lamk.; Kiener, Mon.* pl. 16. fig. 58.

12. Cyllene glabrata, A. Adams. *C. testâ ovato-fusiformi, glabratâ, cincreâ, fasciis albis tribus transversis rufo-articulatis ornatâ, longitudinaliter subplicatâ, plicis infernè evanidis, supernè et infernè transversim striatâ; aperturâ angustâ; columellâ anticè obliquè plicatâ, labro anticè subsinuato.*

Hab. Pasicao, 9 fathoms, fine sand; *H. C.*

November 12.—W. Yarrell, Esq., V.P., in the Chair.

Professor Owen read a paper "on the Cranium of the large species of *Dinornis* called *giganteus* and *ingens**." He commenced by referring to a former memoir, in which four generic types of structure had been determined in fossil crania of birds from New Zealand, viz. *Nestor, Notornis, Palapteryx,* and *Dinornis* proper; and proceeded to describe an additional series of fossil skulls obtained by Governor Sir George Grey from a cave in the district which lies between the river Waikato and Mount Tongariro, in the North Island. The most re-

* This paper will appear in the Transactions as *Dinornis*, Part V., in continuation of Prof. Owen's previous memoirs.

markable of these specimens was an almost entire skull, measuring eight inches in length and five inches across the broadest part of the cranium; which in the extent of the ossified part of the mandible and its downward curvature, resembled the smaller skull described in a former memoir, and there referred to *Dinornis*. In the structure of the occiput and base of the cranium, this large skull more resembled the characters of that ascribed to *Palapteryx*. The indications of the muscular attachments, and the form and size of the massive beak, bespoke the great power and force with which it had been habitually applied in the living bird.

Its anatomical characters were minutely detailed. Comparisons of the area of the occipital foramen for the transmission of the spinal marrow with that of the spinal canal in different vertebræ, were made with a view of determining the species to which the cranium in question might belong; and the peculiar contraction of the spinal canal in the vertebræ of *Dinornis* as compared with that in the Ostrich was pointed out. The inference deduced was, that the cranium, notwithstanding its great size, belonged probably to the species called *Palapteryx ingens*, which was the second in point of size.

A mutilated cranium of a much younger bird, showing all the sutures, but of nearly equal size with the skull first described, might belong to the *Dinornis giganteus*. Two crania, referable to two distinct species of smaller birds of *Palapteryx*, were described, and sections of the cranium were shown, to demonstrate the form and character of the brain. In the collection transmitted by Governor Grey, Professor Owen had, for the first time, recognized a portion of a diminutive wing-bone, similar, in the absence of the usual processes for the muscles of flight, to that in the *Apteryx*, and confirmatory, both by this character and its extreme rarity, contrasted with the abundance of vertebræ and leg-bones that had been transmitted, of the inference as to the rudimental condition of the wings in the *Dinornis* and *Palapteryx*.

The memoir concluded with a description of a cranium of the *Notornis*, more perfect than that fragmentary one on which the affinities of that bird to the *Rallidæ* or Coot-tribe had originally been founded, and its generic distinction from *Porphyrio* established. The specimen exhibited confirmed the accuracy of the conjectural restorations in the figure of the original specimen in a former volume of the Transactions of the Society.

BOTANICAL SOCIETY OF EDINBURGH.

Dec. 11, 1851.—Professor Balfour, President, in the Chair.

Dr. Balfour read a letter from Dr. Dickie, mentioning the occurrence of *Carex rigida* close by the sea, within reach of the spray, on Downpatrick Head; also the occurrence of *Hieracium nigrescens*? and of *Hypnum rufescens* on Ben Bulben.

The following papers were read:—

1. "Notice of the *Hieracium plumbeum* (Fries) as a British plant," by James Backhouse, jun.

"It grows on Falcon Clints, in Teesdale. Having had an opportunity of examining specimens of the Norwegian *Hieracia* during the past summer, partly by collecting personally, and partly through the kind assistance of Professor Blytt, of Christiania (from whom I have received a large dried collection), I am able satisfactorily to identify this plant, which has all the appearance of a good and *distinct* species. It is most nearly allied to *H. cæsium,* but differs strongly in having more truncate involucres, with *broad based acuminate apiculate scales* of a dark colour margined with green; also, in the *involucres, and peduncles* being almost or entirely *destitute of stellate pubescence. H. cæsium* from the same place, and from Cronkley Scar, Teesdale, has narrow, *acute,* involucral *scales,* and usually a *large amount of stellate down on the peduncles and involucres. H. plumbeum* flowers *very early* (say about July), while *H. cæsium* is in perfection or nearly so in September. I have the plant in cultivation from Falcon Clints, and under these circumstances it becomes still more dissimilar. It agrees well with my Norwegian specimens, and still better than they do with the description in Fries's Monograph."

2. An extract of a letter from Dr. Gilbert M'Nab, dated Jamaica, 1st November, 1851:—"Some time ago, I sent some dried specimens of a small plant, which I supposed was a floating aquatic fern, but I have now discovered what it is. In the water-tank in my garden is a very large and luxuriant plant of the *Nymphæa ampla* which seeds very freely; the seeds are surrounded by a spongy-looking arillus, which floats to the surface all those that get disengaged from the mud, where the capsule is ripened, and whilst floating on the surface they there vegetate, and after a time sink and take root in the mud; the small leaf-looking bodies are the submersed leaves of the plant; they are of a similar shape, but totally different in texture from the floating leaves. I also notice in the *N. ampla* what I have never seen in any of the family, that it produces as many purely male flowers as it does hermaphrodite. I have not yet seen any pure female flower, although I dare say I shall. I was thinking of putting some up in brine, as they may be interesting."

3. An extract of a letter from Mr. John Goldie, Ayr, Canada West (late of Ayrshire):—

"I observe, that at one of your botanical meetings there was a discussion about what kind of trees were generally struck by lightning. One morning no less than four trees were struck by lightning within three miles of this place: all were gigantic specimens of the Weymouth pine, *Pinus Strobus.* I do not recollect seeing any other sort of tree which had been injured by lightning in this part of the country. In all the cases which I have examined, the electric fluid proceeded from the top to the root, following the grain of the wood, and cutting out the bark 2 or 3 inches in breadth all the way, as if it had been scooped out with a gauge."

4. Mr. M'Nab laid before the Meeting a list of the Temperatures observed in the Botanical Garden, from 1st November to 9th instant.

5. "Notice of a new British *Viola,*" by Charles C. Babington, M.A. (See p. 12.)

6. "On *Fuchsia*, considered morphologically," by the Rev. Dr. M'Cosh.

The branches of the species selected are whorled in threes, as are also the leaves. The normal angle of the branches is about 60°, that of the leaf also 60°.

I now endeavoured to find whether the curve of the branchlets and the curve of the vein corresponded. This I found to be difficult; but it occurred to me to try and find the law of the ordinates of the curves, and the result shows that the ordinates increase by equal increments in equal spaces, and that the increment is = to the abscess. This was the law of the curve of the branches and of the veins of the leaves.

7. "On Monstrosities of the Dandelion and common Clover observed near Turin," by Charles Murchison, M.D., British Embassy, Turin.

8. "On the Flora of Bonn, on the Rhine," by G. S. Blackie.

Mr. Blackie observed, during his three months' stay in the neighbourhood of Bonn:—

Dicotyledones	586	species.
Monocotyledones	175	,,
Acotyledones..........	28	,,
Total number of species..	789	

9. "Microscopical Observations on a kind of Paper made from Vegetable Tissue," by John Matthews. Mr. Matthews had examined the specimen of paper presented at the last meeting of the Society, and found that it exhibited beautiful cells with stomata. It was, therefore, the cuticle of a plant, and from the quadrangular stomata he was disposed to think that it was allied to *Agave*.

Dr. Seller was elected President for the ensuing year.

MISCELLANEOUS.

Observations on the genus Acostæa *of D'Orbigny.* By J. E. Gray, F.R.S., V.P.Z.S. &c.

M. D'Orbigny, in the 'Revue et Magazin de Zoologie' for 1851, pp. 60 & 185, t. 3. describes a new freshwater Bivalve discovered by Col. Acosta in New Grenada, under the name of *Acostæa*; the following is an abridgement of his characters:—

"The *young shell* is free, equivalve, inequilateral, thin, closed; the ligament elongate, convex; the interior, like *Anodontæ*, with two muscular scars; characters determined by the elongate form of the shell. In the intermediate age, while enlarging, the shell suddenly leaves its regular form, being till now free. It lies on its side, the *right* valve below, which moulds itself upon the body which it touches, extends itself on the substance and fixes itself there. The ligament remains on the side of the valves. The *left* valve now becomes the upper one, and commences to open itself at the anal region; it then

continues slightly gaping for some time, after which it separates itself entirely from all that characterized it in its early state, to become irregular like the opposite valve, detaching itself entirely from its early state (the two valves of its early existence), which remain attached to the apical part of the inferior valves only.

"In the adult age the shell is irregular, very variable in its form, and very inequivalve. The inferior valve is fixed by means of its substance, or rather filling and levelling all the inequalities of the substance on which it rests, so as to solder it there, without however in any part losing its external epidermis. It is generally oblong, rounded behind, ending in a more or less long and irregular talon, always roughened by the lines of growth; the two anodontiform valves of the young age are invariably found at the tip; the interior is unequal, with a single subcentral muscular scar."

The animal of this shell has not been observed.

M. D'Orbigny compares the shell with the genera *Etheria* and *Ostrea*, but by a very extraordinary oversight does not make any comparison of it with the genus *Mülleria* of Férussac, with which it agrees in every character, except that the specimens of that genus described by Férussac and Sowerby appear to have been imperfect at the tip, so as not to exhibit the "anodontiform valves."

M. D'Orbigny describes the adult shell as fixed by the *right* valve; but his figure represents it as fixed by the same valve as the attached valve in the genera *Mülleria* and *Etheria*, which we have always called the left one, because it is on the left side of the animal when it walks. Férussac properly described *Etheria* as attached by its left valve, observing that it is rarely fixed by the other.

The regular form and free state of the young shell is not a peculiarity of this genus, but is common to all the attached Mollusca; but in this genus the young animals appear to continue free for a longer period than is usual; yet some bivalves, as *Hinnites* for example, which eventually becomes attached, often remain free for a much longer period; indeed, until it has reached nearly its adult size. The great peculiarity of this genus is the fact of the upper or free valves becoming separated from the apical or young state of the shell; but this is easily explained when we consider that the first time the animal opened this valve after it became attached, it must break the valve away from the fixed apex.

M. D'Orbigny lays great stress on the fact that the young shell has two muscular scars, and the adult only one; hence in its young state it would be a *Dimyaire*, and in its adult one a *Monomyaire* of Lamarck But it is to be remarked, first, that this idea has not been verified, for the shell has not been seen in its young state, and the two muscles are only supposed to exist because of the external forms of the young shells; and secondly, if it is true, it only teaches us what Nature is constantly teaching us—not to place too exclusive reliance on a single character, however general. While it does so, it does not in the slightest degree militate against the value of the character derived from the size or number of the muscular scars to distinguish the families and

genera of Bivalves; and at the same time it shows how careful Nature is to do nothing in excess; for it must be plain to every one, that while a free oblong shell will require two abductor muscles to keep the valves in their place with regard to each other, a more or less orbicular shell attached by the outer side of one of its valves will only require a single subcentral muscle to effect the same object.

It appears to me that the genus *Acostæa* is only a synonym of the genus *Mülleria* of Férussac, and that it and *Etheria* must be referred to the same family; and I have no doubt that when the young shell of *Etheria* has been observed, it will resemble that now first observed on the tip of *Acostæa*. The one is an African, and the other an American genus.

Notice of the Sea Bream, Pagellus centrodontus, *Cuv., taken in the Firth of Forth.* By JOHN ALEXANDER SMITH, M.D.

A very beautiful specimen of the sea bream, *Pagellus centrodontus*, Cuv., was taken in a trawl-net off the Isle of May, near the mouth of the Firth of Forth, on Saturday the 29th of November last. It is $18\frac{1}{2}$ inches in length to the extremity of its forked tail, breadth across from dorsal to ventral fins about 6 inches.

Number of fin rays: D. $12+13$; P. 17; V. $1+5$; A. $3+13$; C. 17.

Dorsal fin brown, edged with red; pectorals nearly 5 inches in length, and like tail of a red colour; ventrals gray, with large red spot in centre; and anal gray, with longitudinal red stripe.

Teeth nearly equal, sharp and pointed in front and edges of jaws, more rounded behind; in four or five rows, the inner the largest posteriorly; pharyngeal teeth sharp-pointed and thickly set together; peritoneum lining abdomen of a blackish brown colour; stomach roundish, rather muscular, contained remains of small fish like herring fry; just beyond pylorus four cæca encircling bowel, one short and others nearly equal; intestine bent twice upon itself before reaching anus; ovaries rather small; air-bladder large and undivided.

It appears to be a very rare fish, or at least to be very rarely caught in our neighbouring seas, as far as I have been able to ascertain.

On the Circulation and Respiration of the Annelida. By M. A. DE QUATREFAGES.

In the first portion of this memoir, M. de Quatrefages, by the observation and dissection of numerous types, confirms the general conclusion arrived at by Milne-Edwards in his investigations, namely, that in the circulatory system of the Annelida, the division of the physiological labour is carried to very different degrees, from a complete system, furnished with a true capillary network, to that of a blood-vessel which exists only in the neighbourhood of the branchiæ; it is not impossible that the circulatory apparatus may disappear entirely; at least this appears to be the result of the observation of some small

transparent Annelida, somewhat like *Terebellæ*, for which M. de Quatrefages proposes the generic name of *Apneumea*.

The blood of the Annelida is not always red, as was supposed by Cuvier; it is frequently colourless, in many cases it is green, so that nothing general can be said on this subject; it is perfectly liquid and presents no trace of globules, except however in the *Glyceræ*.

In the second part, M. de Quatrefages examines the organs of respiration, which present no less variability than those of circulation, as may be seen by the following résumé:—

1. Respiration general and entirely cutaneous (*Lumbriconereis*).

2. Respiration cutaneous, but confined to certain segments (*Chætopterus*).

3. Respiration cutaneous, but confined to certain points of each segment (*Nereis*).

4. Respiratory organ taking the form of a simple cæcum or bladder into which the blood flows (*Glycera*).

5. The branchia is characterized more and more by the formation of a canal in communication with larger or smaller lacunæ.

6. These branchiæ may be distributed all along the body (*Eunice sanguinea*).

7. They may be confined to a certain number of segments placed towards the middle of the body (*Arenicola, Hermella*).

8. They may all be placed at the extremity of the body so as to form a double tuft (*Serpula*).—*Bibl. Univ. de Genève*, Sept. 1851, p. 73.

On the Organ of Smell in the Fluviatile and Terrestrial Gasteropodous Mollusca. By M. Moquin-Tandon.

In the lower animals it is difficult and often impossible to ascertain exactly what are the organs which preside over the senses, either of hearing or smell; in many cases it is difficult to prove certainly the existence even of these sensations. In this memoir, M. Moquin-Tandon seeks to prove not only that the Gasteropoda enjoy the sense of smell, but also that the seat of this sense is at the extremity of the tentacles.

As to the first of these points, the result of various experiments appears to be in the affirmative: thus we frequently see snails and slugs proceed in a direct line towards substances of which they are fond, although they do not see them; if the object is removed, or put in a different place, the animal will stop, or change its direction. If there appears to be no doubt upon this point, it is by no means the case with the second, as M. Moquin shows by passing in review the various hypotheses which have been proposed on this subject; he himself thinks that the sense of smell resides in the extremities of the superior tentacles in the quadritentaculate Gasteropoda. In fact, if we dissect a tentacle, we find in it a nervous trunk which terminates in a small dilatation in the terminal knob, after having given rise, at two-thirds of its length from the base, to a delicate filament, which is the optic nerve. What appears to prove that it is this nervous fila-

ment which serves for the perception of odours, is, that if the tentacles of a Gasteropod, an *Arion* for example, be carefully cut and the wounds allowed to heal, it will no longer approach certain nutritive substances in the same manner as before the operation. M. Moquin has also remarked that the size of this tentacular nerve was proportional to the strength of the faculty of smell possessed by the Mollusca; thus it is very large in the *Testacellæ* which feed on earthworms, which they are obliged to pursue in their subterraneous galleries.

In the bitentaculate Gasteropoda the olfactory organ also resides in the tentacles; but in this case the eyes are placed at the base, the sense of smell can be exercised on their entire surface, and it is clearly separated from that of sight.—*Ib.* Nov. 1851, p. 247.

Monstrosity in the petals of Honkeneja peploides. By Charles C. Babington, M.A.

My friend Mr. J. B. Wilson of St. John's College, Cambridge, has recently placed in my hands a rather curious instance of change of form in the petals of a caryophyllaceous plant. In the *Honkeneja peploides* the plants are subdiœcious with us, although such is stated by Dr. A. Gray not to be the case in America. The petals of the male flower are usually broadly obovate-spathulate and equal, even if they do not exceed, the sepals in length. In the plant before me, which is male, the petals are mostly much shorter, but retain their proper shape. In a few flowers the petals are divided to about the middle into linear lobes. As many of the allied genera have deeply cloven petals, this instance is chiefly of value as showing that we must not trust even that structure as affording constant characters.

ANAS GLACIALIS.

To the Editors of the Annals of Natural History.

Weymouth, January 20, 1852.

Gentlemen,—On Saturday, January 17th, 1852, a specimen of *Anas glacialis*, the Long-Tailed Duck, was shot by a gentleman of this town, in Weymouth Bay: it is evidently a young male. The elongated tail-feathers are absent. On each side of the neck is an ill-defined dark spot, and a narrow band of black encircles the lower part of the breast and joins the black of the back. The legs and feet are bluish lead-colour. This bird had been chased by a gunner, who had eight shots at it. He first shot at it on the wing, when it immediately alighted and dived, and would not rise again, but dived each time it was shot at. When on the wing it flew in the same manner as the tufted duck, and dives better and keeps longer under water than the guillemots or razor-bills. The extreme length of the above is 14 inches (French).

I have just had brought me a specimen of *Rhombus hirtus*, Müller's Topknot, being the first I have seen on this coast.

Gentlemen, yours obediently,

William Thompson.

Mollusca dredged in Cork Harbour during the Summer of 1851. By Samuel Wright and J. Carroll.

Sphænia Binghami, Turt. Several perfect examples.
Thracia villosiuscula, Macg. Rather frequent.
T. pubescens, Pult.
Tellina pygmæa, Philippi.
Astarte triangularis, Mont. (sp.). A few dead specimens. (Also in shell-sand from Kilkee, J. Wright.)
Cardium fasciatum, Mont. Frequent.
C. pygmæum, Don. Frequent.
Lucina spinifera, Mont. (sp.). A single living example.
Montacuta ferruginosa, Mont. (sp.).
M. bidentata, Mont. (sp.).
Kellia rubra, Mont. (sp.).
Lepton squamosum, Mont. (sp.). Odd valves frequent: two young living specimens occurred.
Nucula nitida, Sowerby.
Rissoa striatula, Mont. (sp.). Dead.
R. vitrea, Mont. (sp.). Several dead individuals.
R. proxima, Alder.
R. fulgida, Adams (sp.). One dead example.
Cæcum glabrum, Mont. (sp.).
Cerithium adversum, Mont. (sp.). A few perfect specimens.
Scalaria clathratula, Mont. (sp.). Common.
Chemnitzia rufescens, Forbes. One dead example.
Odostomia obliqua, Ald. Dead.
Mangelia teres, Forbes. Dead.
M. gracilis, Mont. (sp.). Two dead individuals. (We dredged in the same locality a fine living specimen in June 1850.)
Cylichna nitidula, Lovén.
C. strigella, Lovén.

These rare *Cylichnæ*, with *Chemnitzia rufescens, Odostomia obliqua, Astarte triangularis*, and *Mangelia teres*, appear to have been washed into our harbour from deep water.

Cæcum trachea, Mont. (sp.). Youghal, J. Wright.
Rissoa soluta, Forbes and Hanley. In shell-sand from Bantry, 1850; S. Wright.

On the General Cavity of the Body of Invertebrate Animals. By M. A. de Quatrefages.

In this memoir, M. de Quatrefages seeks to give a clear and distinct idea of the mode of disposition of the organs in the bodies of Invertebrata, and of what is understood by the general cavity in these animals. According to him, by general cavity must be understood the more or less circumscribed, more or less free space contained within the walls of the entire body and in which the internal organs are enclosed. This general cavity, indistinctly marked in the superior animals in which it is filled with various organs, acquires great im-

portance in the lower animals, either from the intimate relations in which it stands to the organs, or because of the liquid which it contains.

In the *Hydræ,* the general cavity is entirely confounded with the digestive cavity, for it contains no organs and replaces them all; in the *Actiniæ* it is prolonged into the tentacles, and in the middle of it are suspended the reproductive organs and the alimentary canal, with the latter of which it is in direct communication.

In the Mollusca and Articulata, the general cavity is more circumscribed, and communicates directly with the circulatory system. Lastly, in the Echinodermata and Annelida it is completely closed.

Very apparent in some cases, in many others it is frequently disguised by a network cf filaments, more or less close, which, uniting the organs to the walls of the body, play the part of cellular tissue. Between these two extremes every possible intermediate form is found.

Whatever may be the arrangement of the general cavity, it is always lined with a membrane, which is produced with the various organs communicating with it, and may be assimilated to a true peritoneum.

The general cavity is always filled with a liquid, the nature of which varies with the form of the cavity itself: if this communicates with the digestive cavity, the liquid will be water, as may be seen in the *Actiniæ*; if it communicates with the circulatory system, it will be full of blood, which is the case in Insects, Crustacea, &c. Lastly, if it be closed, it is filled with a serous fluid secreted by the membrane. The functions of this liquid are important, for it takes a principal part in nutrition, after having been submitted in various modes to oxygenation; it is in it that the eggs and spermatozoa are developed and accomplish their different phases of evolution; and lastly, it assists in locomotion by causing exsertion of the locomotive organs under the influence of muscular contraction.—*Bibl. Univ. de Genève,* Sept. 1851, p. 72.

EARLY FLOWERS.

In a letter received from our friend Dr. T. Forster, dated Bruges, Jan. 27, 1852, we are informed "that all the *Tulipæ suaveolentes* have flowered this year in *January,* while the Hyacinths and Narcissi are a month behind time."

Dr. Grant, F.R.S.

A subscription is forming under the auspices of an influential committee of scientific men, chiefly naturalists, for the purpose of presenting a testimonial to Dr. Grant, the eminent Professor of Comparative Anatomy and Zoology in University College. Professor Grant early relinquished the pecuniary advantages of his profession as a physician, in order to devote himself unreservedly to the pursuits of Comparative Anatomy and Zoology. He spent a considerable

patrimony in travelling throughout Europe, in studying at various universities, in order to acquire an extensive knowledge of his favourite branches of Natural History, and in making original observations and researches at home and abroad. He was one of the first, in this country, to teach these sciences in separate and extended courses of lectures; and he has been chiefly instrumental, by his numerous publications, and by his lectures, in diffusing a taste for these studies. But, though highly advantageous to the public, Dr. Grant's labours have not been profitable to himself in a pecuniary point of view, because attendance on courses of lectures on these subjects is not compulsory on candidates for diplomas or degrees; and his income, having been entirely dependent on the number of his pupils, has in some years been extremely limited. It is only within the last few months that the Council of University College has been enabled to grant to him an income of even 100*l.* per annum, beyond the returns of his class. Between two and three hundred pounds have been already subscribed, and it is proposed to present the offering in the acceptable form of an annuity. More subscriptions are, however, needed for an adequate recognition of Dr. Grant's thoroughly learned, unostentatious, and independent character; and we cannot do better than close our remarks with the name and address of the treasurer—J. S. Bowerbank, Esq., F.R.S., 3 Highbury Grove, Islington.

METEOROLOGICAL OBSERVATIONS FOR DEC. 1851.

Chiswick.—December 1. Frosty: fine: uniformly overcast at night. 2. Overcast: clear. 3. Hazy: cloudy: frosty at night. 4. Frosty: fine. 5. Hazy: cloudy: overcast. 6. Densely overcast. 7. Fine: cloudy. 8. Cloudy: clear and very fine. 9. Foggy. 10. Cloudy. 11. Clear and fine. 12. Very dense fog. 13. Foggy: hazy throughout. 14. Foggy. 15. Hazy. 16. Foggy: overcast. 17, 18. Foggy. 19. Very fine. 20. Hazy and drizzly: densely overcast at night. 21. Rain: boisterous at night. 22. Rain: clear at night. 23. Clear and fine. 24. Hazy: fine. 25. Clear and fine: cloudy at night. 26. Fine: sharp frost. 27. Frosty: overcast: slight rain. 28. Fine: densely clouded: clear. 29. Slight haze. 30. Foggy. 31. Frosty and foggy: hazy.

Mean temperature of the month	38°·88
Mean temperature of Dec. 1850	38 ·47
Mean temperature of Dec. for the last twenty-six years	39 ·69
Average amount of rain in Dec.	1·52 inch.

Boston.—Dec. 1. Fine. 2—4. Cloudy. 5. Cloudy: rain A.M. 6. Cloudy. 7—9. Fine. 10. Cloudy: rain P.M. 11, 12. Fine. 13. Foggy. 14—19. Cloudy. 20. Fine. 21. Rainy: rain A.M. and P.M. 22. Cloudy. 23. Fine. 24. Cloudy. 25, 26. Fine. 27. Cloudy. 28. Cloudy: rain P.M. 29, 30. Cloudy. 31. Fine.

Sandwick Manse, Orkney.—Dec. 1. Cloudy: damp. 2. Damp. 3. Showers: damp. 4. Rain: showers. 5. Showers: drizzle. 6. Bright: drizzle. 7. Cloudy. 8. Damp: showers: clear. 9. Damp: drizzle. 10. Cloudy: rain. 11. Damp: drizzle. 12. Bright: cloudy. 13. Drizzle: clear. 14. Fine. 15. Fine: damp. 16. Bright: fine: damp. 17. Damp: fine: damp. 18. Bright: fine: aurora. 19. Cloudy: fine: aurora. 20. Cloudy: drizzle. 21. Rain: clear: aurora. 22. Frost: clear: aurora. 23. Bright: clear: aurora. 24. Frost: aurora. 25. Frost: cloudy. 26. Fine: clear: aurora. 27. Fine . cloudy. 28. Cloudy. 29. Cloudy: damp. 30. Drizzle: rain. 31. Drizzle: cloudy.

Meteorological Observations made by Mr. Thompson *at the Garden of the Horticultural Society at* Chiswick, *near London; by* Mr. Veall, *at* Boston; *and by the* Rev. C. Clouston, *at Sandwick Manse,* Orkney.

Days of Month.	Barometer.					Thermometer.					Wind.			Rain.		
	Chiswick.		Boston. 8¾ a.m.	Orkney, Sandwick.		Chiswick.		Boston. 8¾ a.m.	Orkney, Sandwick.		Chiswick. 1 p.m.	Boston.	Orkney, Sandwick.	Chiswick.	Boston.	Orkney, Sandwick.
1851. Dec.	Max.	Min.		9¼ a.m.	8½ p.m.	Max.	Min.		9¼ a.m.	8½ p.m.						
1.	30·257	30·245	29·97	30·32	30·31	39	32	32	42	42	w.	nw.	nnw.	......	......	......
2.	30·267	30·233	29·87	30·24	30·23	41	27	38	41½	41	nw.	wnw.	nnw.	......	......	......
3.	30·285	30·187	29·94	30·16	30·16	39	24	35·5	40	39½	sw.	wnw.	sw.	......	......	·07
4.	30·245	30·234	29·90	30·02	29·93	43	35	30	43½	50	sw.	w.	wsw.	......	......	·07
5.	30·241	30·229	29·85	29·81	29·74	47	39	43	48	50	sw.	w.	w.	·02	......	·20
6.	30·221	30·204	29·77	29·64	29·60	49	44	49	50	50	sw.	w.	ssw.	......	·05	......
7.	30·202	30·069	29·78	29·55	29·42	51	40	42	50	49	s.	sw.	s.	......	......	·03
○ 8.	30·214	29·919	29·46	29·02	29·75	54	25	48	47	47	w.	sw.	wnw.	......	......	......
9.	30·189	30·091	29·72	29·51	29·46	54	52	40	45	50	sw.	ssw.	s.	......	......	·42
10.	30·038	29·981	29·50	29·38	29·54	53	33	51·5	49	45	s.	sw.	w.	......	......	·27
11.	30·521	30·366	29·94	29·94	30·16	51	27	43·5	49	51½	w.	wsw.	wsw.	......	·04	·41
12.	30·516	30·442	30·12	30·24	30·26	38	30	32	50	47	nw.	w.	wsw.	......	......	......
13.	30·404	30·389	30·08	30·41	30·48	44	37	35	50	46	e.	calm	ssw.	......	......	·02
14.	30·472	30·414	30·13	30·45	30·37	41	36	42	43	42	e.	e.	s.	......	......	·03
☾ 15.	30·437	30·387	30·07	30·22	30·08	40	36	38	41	48	s.	w.	ssw.	......	......	......
16.	30·365	30·336	29·96	30·04	30·11	43	39	38	46	43½	sw.	s.	ese.	·01	......	·23
17.	30·301	30·232	29·94	30·08	30·00	44	32	43	45	43	s.	nw.	calm	......	......	·05
18.	30·185	30·136	29·86	29·73	29·76	45	34	36	43	45	s.	nw.	ssw.	......	......	......
19.	30·118	29·995	29·70	29·77	29·75	52	43	42	44	41	s.	n.	se.	·01	......	......
20.	30·087	29·968	29·67	29·55	29·41	53	46	48	45	48½	s.	n.	se.	·02	......	......
21.	29·760	29·564	29·35	29·36	29·53	49	38	49	43	39	sw.	nw.	se.	·15	......	·29
● 22.	29·832	29·543	29·31	29·62	29·87	46	35	41	36	43	e.	n.	nw.	·31	·45	·03
23.	30·226	30·063	29·75	30·07	30·16	46	30	37	44	41	ne.	n.	sw.	......	......	·03
24.	30·288	30·261	29·95	30·15	30·13	41	24	32	36	37	se.	nw.	ese.	......	......	......
25.	30·357	30·318	29·98	30·18	30·32	41	25	34·5	34	38	sw.	w.	e.	......	......	......
26.	30·532	30·439	30·20	30·45	30·52	43	17	32	40	32½	e.	se.	calm	......	......	......
27.	30·488	30·349	30·20	30·49	30·51	40	29	32	39	45½	sw.	nnw.	wnw.	·02	......	......
28.	30·427	30·300	30·12	30·52	30·47	42	31	42·5	46	46½	e.	ne.	w.	·08	......	......
29.	30·493	30·485	30·20	30·27	30·17	40	36	38	49	49	ne.	ne.	w.	......	·04	......
☽ 30.	30·488	30·398	30·12	30·06	29·92	40	21	36	46½	49	sw.	w.	w.	......	......	·14
31.	30·262	30·044	29·91	30·85	29·88	36	28	34	46½	42½	sw.	sw.	calm	......	......	·30
Mean.	30·281	30·188	29·88	30·003	30·000	44·67	33·09	39·1	44·25	44·58				0·62	0·58	2·59

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SECOND SERIES.]

No. 51. MARCH 1852.

XIII.—*On the Gangetic Dolphin.* By Dan. Fred. Eschricht, Professor at the University of Copenhagen. Being a Supplement to his Memoirs on Whales. Transactions of the Royal Danish Academy of Sciences, 5th Series, vol. ii. (separately printed, Copenhagen, 1851, 4to.) Translated from the Danish by Dr. Wallich, F.R.S., Vice-Pres. Linn. Soc.

[With three Plates.]

Among the harvest produced by the memorable circumnavigation of the Corvette "Galathea" are important contributions to the knowledge of the very remarkable Dolphin inhabiting the Ganges, called *Sousou** by the Hindoos, the *Delphinus gangeticus* or *Platanista gangetica* of systems.

While the vessel was moored off Calcutta during the night of the 2nd and 3rd of December, a young, not quite full-grown individual was caught in a fishing-net, a little below the Botanic Garden, which our countryman, Dr. Wallich†, presented to the expedition. Scarcely ever has a more favourable opportunity presented itself for its examination. Though by no means a rare animal in that river, the Platanista, like all other sorts of the

* Prof. Wilson has kindly furnished me with the following Indian nomenclature of this remarkable animal:—

Sanscrita, *Sisumára*; Hindustani, *Sons*; Bengali, *Sishuk*, *Sishumár*.—N. W.

† The translator omits the very flattering terms, in which his humble services are mentioned by the distinguished author; the more so, as he is conscious he did only what was his bounden duty towards his native country, and the situation he had the honour of holding at the time in question. The friendly intercourse which he enjoyed, during the short sojourn of the "Galathea" in Bengal, with her glorious commander and officers, and the distinguished party of scientific gentlemen and artists accompanying the expedition, will always continue among the most pleasing recollections of his Indian career. A very valuable and interesting account of the voyage, by Commodore Steen Bille, has been completed at Copenhagen, 1849–1851, in 3 vols. 8vo.

Whale tribe, not particularly sought after, is only accidentally caught in the net of the fisherman; and consequently it rarely reaches the naturalist in a sound condition, especially under the hot sun of India. In the present case, however, the animal was instantly forwarded to M. Reinhardt, the distinguished zoologist of the expedition. The painter attached to his department, Mr. Christian Thornam, immediately depicted it; the dimensions were carefully noted, and a skeleton prepared, no doubt the completest which exists anywhere. M. Reinhardt, further, collected on the spot various data connected with the habits of the animal, forming important matter for a closer acquaintance with a member of the family of Whales, so remarkable on account of its skeleton and outer form. It was M. Reinhardt's intention to have undertaken the subject himself; but as it was desirable that no time should be lost, and as he was about leaving for South America for some years, on a scientific voyage, having only lately returned from those shores, where he quitted the "Galathea," he very readily, and in the most friendly manner, transferred all his materials to me, on purpose that I might prepare a memoir for the Academy's Transactions; an undertaking, which I acknowledge was attended with no small responsibility. In order to point out the importance of the subject, and the mode in which I propose treating it, it appears to me to be necessary to take a view of our acquaintance with the Gangetic dolphin, up to the present time.

The honour of first making the animal known to the scientific world is justly shared between the Danish missionary Lebeck of Tranquebar*, and Dr. Roxburgh of Calcutta†, who simultaneously, in 1801, published an account of it, as inhabiting the Hoogly, one of the lowest branches of the river‡. Both accounts

* Delpinus gangeticus beschrieben vom Herrn Heinrich Julius Lebeck zu Trankenbar. Der Gesellschaft Naturf. Freunde zu Berlin neue Schriften, 3 Band. Berlin, 1801, p. 280-282. t. 2.

† An account of a new species of *Delphinus*, an inhabitant of the Ganges. Asiat. Res. vol. vii. Calcutta, 1801, 4to, p. 170–174. t. 5.—I have been enabled to quote the original edition of this expensive work (commenced in 1788), which was presented by Dr. Wallich to the University Library. The two London reprints are commonly quoted; one in 4to, began in 1799, having the same paging; the other in 8vo, in 1801. Sir E. Home erroneously dates Roxburgh's memoir from 1781; and Fred. Cuvier states the former to have dated it from 1721, asking at the same time, whether the 'Researches' already then existed?—a question which turns upon a twofold mistake.

‡ I have left out a slight error here: it was only Dr. Roxburgh, who resided on the banks of the Ganges, or rather the Hoogly. On consulting the above-cited place in 'Schrift. der Gesellsch. Nat. Fr.,' I find from an immediately following paper of the Rev. Dr. John, Missionary at Tranquebar, on the *Uranoscopus Lebeckii*, that this missionary Lebeck, had visited the Cape of Good Hope, Ceylon, and the coast of Coromandel, and was at the time proceeding to Java.—Transl.

correspond entirely as to the outer form and habitat of the animal; both are accompanied by somewhat crude figures, which, contrary to the descriptions, do not quite agree with each other, but are still adequate to point out the striking peculiarities of the animal in its exterior structure, such as the longitudinal fissure of the spiracle, a form which is unique among the whole series of whales; the triangular fanshaped breast-fins; the extraordinary narrowness of the snout, especially as compared with the thick and blunt forehead; lastly, the very diminutive eye ($1'''$ in an individual measuring $6\frac{1}{2}$ feet). Both authors agree in considering it as a new species; and Lebeck gives it the appropriate name of *Delphinus gangeticus*. As soon as these two accounts became known to zoologists, the Gangetic Dolphin was introduced into the system; although it took place only many years after their publication, by various routes and under less significant names.

George Shaw* describes it in these words:—*Narrow-snouted Dolphin. Delphinus rostratus: rostro attenuato. Dolphin with greatly attenuated snout. Known only from the head or bones of the jaws. Supposed to inhabit the Indian Seas. The jaws are extremely narrow in proportion to their length, which is about 2 feet; the teeth are small, not numerous, distant, and shaped somewhat like the molares of quadrupeds.* This description is barely adequate to point out the existence of a hitherto unknown sort of dolphin in the Indian Ocean, but does not give any idea of its essential form or locality.

Up to 1817 Cuvier was unaware of the two accounts received from India. At least he did not take up Lebeck's *D. gangeticus*, but only quoted Shaw's *D. rostratus*†, which he designated *le Dauphin à bec mince*; interpreting, unfortunately, Shaw's "*Indian seas*" as meaning *des mers d'Amérique*, whereby his attention was diverted from the Gangetic locality, towards Canada. Duhamel du Monceau‡ had received from thence some information, accompanied by a very rough representation of a white dolphin, 12 feet long, with a very short snout and vaulted forehead, which Cuvier thought answered to Shaw's *D. rostratus*§.

* General Zoology or Systematic Natural History, vol. ii. part 2. Mammalia. London, 1801, p. 514.

† Le Règne animal distribué d'après son organisation, tome i. Paris, 1817, 8vo, p. 278.

‡ Traité général des Pêches et Histoire des Poissons qu'elles fournissent. Suite de la seconde partie. Paris, 1782, fol. Tom. iv. sect. x. p. 41, § 1. pl. 10. f. 4.

§ Duhamel had received an entire figure of the animal, but used only the anterior half for his work. Long after Cuvier's mistake had been corrected, Mr. J. E. Gray obtained from M. Blainville a complete copy of the above-mentioned old figure, which he transferred to stone, and constituted into a new species, calling it *Inia canadensis* (Zoology of the Voyage

About the time of the publication of Cuvier's 'Règne Animal,' M. Blainville, during his stay in London, saw a pair of dolphin jaws in the Hunterian Museum, no doubt those on which Shaw had founded his *D. rostratus,* which was likewise Blainville's opinion, although he thought fit to make a new species of them, under the name of *D. Shawensis**. The origin of these bones we learn from a little memoir of Sir Everard Home†, who had received them from Sir Joseph Banks in 1801, and had placed them in the Museum, without further notice, until the year 1818, when accidentally meeting with Roxburgh's memoir in the 'Asiatic Researches,' he at once discovered that the bones belonged to the Ganges dolphin. From this time Shaw's *D. rostratus* became merged in Lebeck's *D. gangeticus,* and our acquaintance with the remarkable animal proceeded rapidly. Sir Everard found that Shaw's description of the teeth corresponded so little with the reality, that he was almost led to suppose that it had reference to the teeth of some other animal. He furnished a description of them, which, though unquestionably very incomplete, is of importance, inasmuch as, by means of the elegant figures, we have a fair representation of the remarkable changes which they undergo by age. They are not, however, as the author maintains, originally formed within the gums in whales, growing thence in two directions, partly through the gums in the shape of a compressed cone, covered with enamel, and partly downwards towards the jaw-bone itself; but rather, as is the case among mammalia in general, they become first ossified at the apex while

of H.M.S. Erebus and Terror during the years 1839–1843, London, 1846, 4to, parts 3, 4, 5. Mammalia, p. 45, 46). He concludes by saying, "it can scarcely be a Beluga;" and this would be very right, had the question been a living subject instead of a very crude drawing, which Duhamel states to represent a white dolphin of Canada, 12 feet long, with a very short snout and vaulted forehead. On inspection it will be seen that the drawing wants a dorsal fin, and that the pectoral fins are quite short and broad; and if it is remembered, that at the time Duhamel received the drawing, the *whitefish* had not yet been admitted into the system, and was consequently new to the Parisian naturalist, whose friend in Canada might reasonably have imagined that a mere outline would be acceptable, without anticipating the curiosity which it would excite among European naturalists,—I shall hardly be considered too bold, if I take the figure to represent "simply a *whitefish,* whose short and blunt snout the inexperienced draughtsman had mended a little." (Zoologisch-anatomische, &c. Zoological and anatomical researches concerning the Northern Whales. Leipzig, 1849, 4to, p. 52 *e.*)

* Nouveau Dict. d'hist. nat. appliquée aux arts, à l'agric, &c. par une Société des Naturalistes et d'Agriculteurs. Paris, 1816–1819, 2nd ed., art. Dauphin. [I regret I have not had access to this work, which does not exist at Copenhagen, as far as I know.]

† A description of the teeth of the *Delphinus gangeticus*; read 4th June, 1818, in part 1. of Phil. Transact. for that year, p. 417–419. pl. 21.

quite concealed within the gums; afterwards little by little towards the base of the germ, after the apex has already pierced the gums, and at length round the broad inferior part of the germ, after the apex has long since been worn out. In this manner, then, the animal became at length correctly placed in the system; its locality and form were known from Lebeck's and Roxburgh's accounts; and the changes in its teeth by age were likewise known; the name given by Lebeck was retained, and Shaw's (not to mention Blainville's) was given up*. But it was further reserved for Cuvier to prove, that the Gangetic sort was not only decidedly a very distinct member of the large group of dolphins, but the most peculiar species of all, and most deserving perhaps of constituting a separate genus†. He was aided in these investigations, by an entire skeleton sent to him by our above-named countryman Dr. Wallich; and besides, by two stuffed individuals furnished by the French travellers Diard and Duvaucel; and the latter afforded likewise some data concerning the external female organ (Lebeck's and Roxburgh's specimens being males), and the mode of living, generally, of the animal. Of very great interest is Cuvier's remark, that the *Sousou* of the Hindoos is most probably the very animal which Pliny had in view in the passsage: "in Gange Indiæ Platanistas vocant, rostro delphini et cauda, magnitudine autem xv. cubitorum ‡." So ancient was the knowledge of this large and remarkable inhabitant of the sacred Ganges among the Indians;—so far had the report of its existence spread in the first centuries of our æra, before at length it was introduced to the acquaintance of modern zoologists!

The most prominent points in the skeleton are, first and principally, the very characteristic vaulted bones on each of the upper jaws, rising above the layer of fat before the blowholes (Pl. V. fig. 2); next, the very striking thickness of the zygomatic process of the temporal bone (Pl. VI. fig. 1 t'); the extraordinary narrowness of both jaws, and the corresponding length of the symphysis of the lower, like that of the Cachalot; the small size of the orbits, whereby the zygomatic bone loses entirely its long and slender form, so common among dolphins; the equally unusual proportion of the palatine and pterygoid bones; and lastly, the development of the vertebræ of the neck like that in mammals generally, but in opposition to what exists in all the other dol-

* Cuvier applied subsequently the name *rostratus* to a new species of Dolphin (from the coasts of Europe); but it was justly disapproved; and has yielded to the name *D. bredanensis.*

† Recherches sur les Ossemens fossiles. Nouv. ed. Paris, 1824, 4to, t. v. 1 partie, p. 279–280, 298–300, and p. 307. pl. 22. f. 8, 9, 10. & pl. 23. f. 19.

‡ Naturalis Historiæ lib. ix. c. 15. In Cuvier's edition of Plinii Secundi Libri de Animalibus, Paris, 1827, 1828, 8vo, vol. ii. p. 44–46.

phins. To these peculiarities may be added, further, the proportionally small number of vertebræ, stated by Cuvier to be forty-six (7+11+28).

After Cuvier had concluded his examination of the animal, all the essential points concerning it seemed to have been finally settled, at least as concerned the examination of museums. It was not to be expected that any further observations of importance on the skeleton would be made, especially as no one possessed so complete a one as Cuvier. It was therefore a very acceptable contribution on the part of Mr. J. E. Gray*, who furnished some remarks on the comparison of two Platanista crania in the British Museum, and a third in that of the University of Edinburgh; showing, that the vaulted processes on the upper jaw only approach each other closely towards the middle, during the advanced age of the animal; and that the orifice of the nostrils, in the very young cranium, is "nearly straight," and receives its marked obliquity only in older individuals ("end of the nose recurved"). His figure of the profile of the cranium† appears to be only a reduced copy of Cuvier's, though the teeth are represented as longer.

A faithful representation of the exterior form of the animal was therefore much wanted. Lebeck's and Roxburgh's figures, though quite adequate to fulfill their intention, namely to point out the animal as a distinct species of Dolphin, did not satisfy the desire felt during half a century, to be correctly informed of the exterior figure of an animal, of which the skeleton was so very peculiar, and in a manner to satisfy the demands of the present state of the graphic art. This want was the more urgent, as the two representations alluded to deviated so much from each other, as to give the animal a very different physiognomy; which could not be ascribed to difference of sex or age, since both were males, measured exactly $6\frac{1}{2}$ Engl. feet, and weighed exactly 140 lbs.—a coincidence so striking, that one cannot help concluding, that both accounts were taken from one and the same specimen; the more so as they are contemporaneous (Lebeck alone quoting the place and year of capture—November 1797, $1\frac{1}{2}$ German mile from Calcutta). I anticipate that many zoologists of our time would prefer founding a distinct species on each of those figures; but in cetology, it is obviously unsafe to rely on delineations, invariably given on a greatly reduced scale, while the object itself must have been placed, most frequently, in a very unfavourable position for the artist. Various attempts have been

* *Loc. cit.* p. 45 (where *Platanistina* is a misprint for *Platanista*), and Catalogue of the Specimens of Mammalia in the Collection of the Brit. Museum, Pt. I. Cetacea, Lond. 1850, 8vo, p. 137.

† *Ibid.* tab. 7. f. 2.

made to furnish a better representation of the Gangetic dolphin than the two old ones; but unfortunately subjects were wanting. R. P. Lesson* had the stuffed specimen in the Parisian Museum before him. His greatly reduced figure resembles most Lebeck's; but the teeth, breast-fins, and blowhole are very faulty. Frederic Cuvier† seems to have given nothing but a more elegant copy of Roxburgh's; the singular curvature in the back has been increased so as to be very unlike the general form of a whale. Sir W. Jardine's figure‡ exhibits an arbitrary deviation from all the others; the jaws are much too thick; the eyes large! But J. E. Gray has been the most unsuccessful in these respects. In the celebrated costly work on Indian Animals§ is a coloured figure, about $1\frac{1}{2}$ foot long, of a young animal, and certainly not reduced beyond three-fourths of the natural size. Some of the details are evidently faithful representations of nature, namely the jaws and teeth; but the body is curved like that of a reptile, contrary to what occurs in any of the Cetacea; the whole animal seems to be lean; the skin is stretched over the vaulted head and sunk deeply into the neck; and apart from the whale-tail, it loses altogether the physiognomy of an animal of that family; not to mention that the eye, ear, and blowhole are far too large‖.

In this state of things, the materials brought home in the Corvette "Galathea" by M. Reinhardt, could not but prove highly welcome, since it was particularly desirable to obtain a faithful representation of the recently caught animal, and as regards osteology, a perfect and complete skeleton. Both these objects have

* Complément des Œuvres de Buffon, ou Histoire naturelle générale et particulière des Mammifères et des Oiseaux découvertes depuis 1788 jusqu'à nos jours. Paris, 1828, 8vo, Cétacés, Atlas, pl. 3. f. 3.

† De l'Histoire naturelle des Cétacés, ou Recueil et Examen des faits dont se compose l'Histoire naturelle de ces Animaux. Paris, 1836, 8vo, pl. 8. f. 2.

‡ The Naturalist's Library, vol. vi. Mammalia. Edinb. 1837, 12mo, pl. 28.

§ Illustrations of Indian Zoology, consisting of coloured plates of new or hitherto unfigured Indian animals from the collection of Major-General Hardwicke. Selected and arranged by J. E. Gray. London, 1830–1834, pt. xv. xvi. pl. 4.

‖ Mr. Gray has kindly enabled me to compare the original drawing at the British Museum, which I have known very many years. The original and copy are alike in all respects but two; the tail-part in the latter has been curved laterally, in order to suit the size of the paper, and the eye and ear have not been duly reduced. On it is Major-General Hardwicke's own handwriting in pencil, stating that it "was made from a living specimen 1000 miles above Calcutta,"—consequently far above the place where the Ganges sends off the Hoogly. This corresponds with what Cuvier says:—"Il remonte en grand nombre dans le Gange, aussi haut que ce fleuve est navigable, mais se plaît particulièrement dans les nombreuses branches qui arrosent le delta du Bengale" (Oss. Foss. v. prem. partie, p. 279).—Transl.

been accomplished. I considered it necessary to have a faithful and unaltered copy of the drawing; and I felt convinced that good and detailed figures of the skeleton, and some of the individual bones, would supply a very great desideratum, as they are still very rare and defective in European collections. It was of importance, next, to verify all Cuvier's data; to extend them so as to answer questions, which have of late years been raised in cetology; and to establish the peculiar character of the Gangetic dolphin, both as to its structure and habits, in order to fix its proper position among other toothed whales—inquiries which form the principal object of the present memoir. Finally, M. Reinhardt's notes, obtained at Calcutta from trustworthy sources, have been of considerable value, under the existing scantiness of our information respecting the locality and habits of the animal. Besides the cranium which he brought home, I had the use of a smaller one sent to the Royal Museum of Natural History, many years ago, by the late Mr. Christopher Mundt, Surgeon at Serampore in Bengal, and most readily placed at my disposal. It is 17 inches long, while the cranium of the "Galathea" skeleton (measuring 62 inches) is $17\frac{5}{6}$ or 18 inches. Several parts were broken off, such as the ossa tympanica or bullæ tympani; but this afforded me the opportunity of examining the parts underneath. I had hopes to be able to offer also the earliest information, how the Gangetic dolphin, so distinct in regard to form and skeleton, differs in its viscera. There was a fœtus in spirits among the collections of the "Galathea," belonging to Professor Behn. But my request to that effect was declined by my respected colleague, who, I doubt not, will in due time do justice to the subject.

M. Reinhardt's specimen measures in length 62 inches, as noticed above, while that in the Museum of Paris is 87 inches (about 90 inches Danish measurement); and Lebeck's and Roxburgh's specimen was $6\frac{1}{2}$ English feet, or about 76 Danish inches. The dried skeleton measures 61″ 11‴ ($64\frac{1}{4}$ English inches): namely, the head 17″ 10‴; the neck 3″ 10‴; the chest 8″ 11‴; loins 8″ 11‴; the tail 22″ 5‴. In my description I follow Cuvier step by step, referring steadily to my figures. He commences by observing* that the very long upper jaw is extraordinarily compressed sideways, and that the intermaxillary bones occupy its upper (Pl. VI. fig. 2 *i*), the upper maxillary bones its lower part (*m*). It deserves to be remarked here, that in the $3\frac{1}{6}$ feet long skeleton, as well as in the smaller cranium in the Royal Museum, these bones are entirely grown together on each side and anteriorly, so that in the latter direc-

* Ossemens Foss. vol. i. p. 298.

tion the line of separation is no longer discernible (Pl. VI. fig. 2). It is further stated by Cuvier, that the intermaxillary bones ascend to the sides of (Pl. VI. fig. 1 *i, i, i*), and even above (*ibid.* ++) the nostril, which in this species is longer than broad. It may not be improper to add to this notice of the external nostril some remarks on the connexion of the bones of the aperture in the Dolphins generally, and in the species before us particularly.

The extension of the intermaxillary bone to the sides of the nostril, as far as the outer and even upper margin of the nasal bones (*n, n*), holds good also in most other Cetacea; that is, all whalebone-whales, and among the toothed, at least the long-jawed whales, or dolphins proper, as also the Hyperoodon; whereas they do not reach so far back in most of the short-jawed whales, for instance in *Delphinus globiceps*, and especially the porpoise. The same difference occurs also, as is well known, among other mammalia, where the intermaxillary bones generally reach to the lateral margins of the nasal bones, which however is not the case, for instance, among Ruminantia. It is assumed, commonly, that in all cases those bones form the anterior (in the human skull the lowermost) margin of the outer nostrils. But, strictly speaking, this is not exactly the case with the Gangetic dolphin, nor with other cetacea, or mammalia generally; at least never from the commencement. The aperture is originally covered *behind* by a cartilaginous wing, which is placed transversely (cleft into two side-wings in whalebone-whales and most other mammalia*), and proceeds from that part of the primordial cartilaginous cranium, which subsequently becomes the ethmoid bone; and *before*, on each side, by a cartilaginous wing, originating from the lateral surface of the part of the said primordial cranium which forms the partition in the cavity of the nose, and is afterwards more or less embraced by the vomer from below. The posterior cartilaginous wing (or the posterior pair) disappears perhaps in all mammalia, except in some whalebone-whales, where it seems to continue cartilaginous; at least in many toothed whales (among these the porpoise), it becomes osseous and covers the lower third of the nasal bones, as a distinct bony plate, between the free portion of the nasal and ethmoid bones. I could not discover this bony plate in the Gangetic dolphin; but I found a depression on the lower part of the bones of the nose for the cartilaginous wing, which most probably had been lost during the process of maceration. Among most mammalia the anterior pair of wings likewise disappears; but it becomes ossified in others, such as the hog, and

* See my fifth memoir on Cetacea, in the Transactions of the Royal Danish Academy of Sciences, div. Nat. Hist. and Mathem., vol. xii. Copenh. 1846, t. 13. f. 1, *e′*.

perhaps in most toothed whales. In the Hog tribe this pair of bones has been very long known as peculiar to it, and usually called the *prenasal bones,* which may always be easily recognized in the porpoise, as a minute, fixed, vascular bone, placed anteriorly in each nostril, close to the septum (exactly where it is found in the Hog tribe). In the *Delph. globiceps* it is somewhat larger. This pair of bones, which might perhaps be more expressively called *ossa narium,* I also found in our dolphin, as a small ossification in the dried cartilaginous covering of the nostril, on each side. The vomer in whales grows gradually upwards, not only before the anterior part of the sphenoid bone, but also before the ethmoid, of which, however, a projecting part continues mostly uncovered (namely that surface which in man is the lowest of the horizontal portion) between the vomer, and the above-mentioned little osseous plate of the lowest third of the nasal bones, or perhaps (in the Gangetic dolphin) the nasal bones themselves (Pl. VII. fig. 2 *v, v*).

The upper jaw projects, as in other dolphins, beyond the frontal bones, in such a manner, that these (Pl. VI. fig. 1 *f, f, f*) are uncovered only in the shape of a small, curved, bony prominence, bounded near the median line, which is pushed strongly to the left side, by the nasal (*n, n*), the intermaxillary (*i*), and the upper jaw-bones (*m, m*); behind, by the last-mentioned and the occipital bone (*o*); but laterally disappearing in the long processus orbitales; the frontal bone on the right side (*f*) protruding in one place like a wedge. M. Cuvier observes (*loc. cit.* p. 298): "Le caractère le plus frappant de cette tête, c'est que les maxillaires, après avoir recouvert comme dans les autres dauphins les frontaux jusqu'aux crêtes temporales, produisent chacun une grande paroi osseuse *, qui se redresse et forme une grande voûte sur le dessus de l'appareil éjaculateur des narines. A cet effet, l'une de ces productions osseuses se rapproche de l'autre, et paroît même la toucher sur les deux tiers antérieurs; mais en arrière elles s'écartent pour laisser passage à l'évent. C'est la ligne de réunion de ces deux parois osseuses qui soutient la carène que le front de cet animal montre à l'exterieur †. En dessous, ces parois offrent plusieurs cavités ou une espèce de réseau formé par des branches osseuses très multipliées. Dans l'animal frais, la plus grande partie de l'espace qu'elles couvrent est remplie d'une substance fibreuse, serrée et assez dure."

I may add to this very graphic description, that the "cavities on the lower part of these bony walls" do in reality (see particularly Pl. VII. fig. 2) by no means occupy the inner side, but lie within the osseous walls or crests themselves, that is,

* Tab. 1. f. 2, tab. 2. f. 1, & tab. 3. f. 2.

† Tab. 1. f. 2.

between their two plates; and that they are seen open only in the macerated cranium, because the inner plate is partly membranous and invested in a net of delicate bony spiculæ, which is destroyed during the process of putrefaction, together with the membrane itself. Cuvier states quite correctly, that the cavity covered by this bony vault is filled in the fresh individual with a dense and somewhat hard mass of fibres; but it must not be supposed, that this mass penetrates the cavities or cells of the bone itself, it being in contact only with the periosteum of the bony sides. The wide gap between the two plates of these crests appears already on their anterior margin, and on that of the whole upper jaw (Pl. VII. fig. 1, behind and parallel to the branches of the under jaw).

Cuvier continues: " Les fosses temporales de cette espèce sont beaucoup plus grandes que dans aucun dauphin, en sorte que leur crêtes supérieures cernent à la partie supérieure de l'occiput* un espace rectangulaire† de deux côtés duquel part à angle droit le reste de la crête occipitale. La suture de l'occiput avec les temporaux‡ et avec les pariétaux§ suit précisément cette crête anguleuse ou occipito-temporale. L'occipital s'avance dans l'espace rectangulaire que nous venons de dire, pour s'articuler en avant avec le frontal||. Une autre particularité de cette tête, c'est la grandeur de son apophyse zygomatique du temporal¶ qui est proportionnée à la grandeur de la tempe. Elle va aussi se joindre à l'apophyse postorbitaire du frontal ** et forme ainsi à elle seule toute l'apophyse zygomatique."

It must be observed here, that this remark applies, on the whole, to all Cetacea, where the zygomatic bone, however long it may be, especially in dolphins generally, always forms the lowest margin of circumference of the orbit, but never of the temporal fossæ; exactly as is seen in the Gangetic dolphin. In dolphins the process of the zygomatic bone is applied, backwards, to the inner surface of the zygomatic process of the temporal bone; and this, too, is decidedly the case in our species (Pl. VII. fig. 1 *z*).

"L'orbite étant très-petit, la tige de l'os jugal†† qui le borne en dessous est beaucoup plus courte que dans les autres dauphins; elle est large et comprimée. Le corps de l'os ‡‡ est plus renflé que dans les autres, mais est placé de même sous les parties voisins du frontal et du maxillaire§§" (p. 299).

The real difficulty in explaining the bones of the cranium of the Gangetic dolphin exhibits itself only as regards the palate. This has the form of a small, prominent ridge along the median line, descending on both sides (if the head is

* Tab. 1. fig. 2. † Tab. 2. fig. 1 *o* (the middle). ‡ Ibid. fig. *b*.
§ Ibid. *t*. || Ibid. *f*. ¶ Ibid. *t'*. ** Tab. 1. fig. 2.
†† Tab. 3. fig. 1 *z*. ‡‡ Ibid. fig. 2 *z*. §§ Ibid. fig. 1, 2.

viewed with the base upwards) into an oblique wall, which slides backwards over a plate of the temporal bone (Pl. VII. fig. 1 *t*) lying before the bulla tympani (g'); but which in other respects, and for the most part, occupies the temporal fossa, in as far as its wall is formed of the frontal bone (f).

Proceeding to the examination of the separate bones of the palate thus constructed, we find (Pl. VII. fig. 1) on the under surface of the cranium, between the side-branches of the lower jaw (x), as we pass backwards, first, the hindermost part of the palatal surface of the upper jaw with its four last teeth. From thence ascends on each side, and in a parallel direction to the branch of the lower jaw, the cleft, mentioned above as separating the two plates of the upper jaw. Then follows the palatal surface of the hindmost of those plates, reaching (where it is marked p) up under the zygomatic bone, and above the temporal plate of the frontal bone, with which it forms a large oblong hole, serving, no doubt, for the passage of the palatal nerve of the fifth pair. This surface is proportionally narrow, and runs parallel to the cleft in the anterior margin of the upper jaw, and consequently also to the lateral branch of the under jaw. The remainder of this long palate—narrow if viewed along its high ridge only, but of considerable breadth if viewed in conjunction with its two oblique surfaces—is made up on each side of one single bone (u), which in the dry cranium is perfectly hollow, consisting of two, or more correctly three, thin, distant plates. One of these plates forms the oblique surface just mentioned; the other forms the hinder part of the side and floor of the nasal cavity (visible in Pl. VI. fig. 3 u); and the third, extending along the median line, corresponds to the opposite plate on the other side, and joins therefore the palatal plate, in the ridge itself of the palate, where, in the macerated cranium, the entrance to the cavity within is wide open. But here, as in the vaults of the upper jaw, the cause of this last appearance lies in the destruction of the periosteum and the bony network which it held together. The proper entrance to the cavity is, where the palatal and nasal plates meet, consequently along the posterior margin of the bone, which looks directly towards the bulla tympani (Pl. VII. fig. 1 g). The inner surface in the median line seems to press closely against that of the opposite plate. By carefully separating the two (which was only practicable, to a sufficient degree, in the smaller cranium belonging to the Royal Museum), a second pair of vertical plates was actually seen between them, inclosing another, third pair, very delicate, like thin paper. Of these two concealed pairs, the first is manifestly an elongation of the anterior part of the palate, which has been mentioned as belonging to the palatal plate of the upper jaw, but is marked p on the figure; the

innermost pair is extremely delicate, and appears only in the hindermost part of the palate; it belongs to the vomer, being no doubt always connate, as is the case generally with the side plates of a perfect vomer along the median line.

A difficulty arises in explaining these bones: we have only two distinct pairs to represent the three palatal bones, namely the bones of the upper maxillary, the palatal and the pterygoid bones. Cuvier intended apparently to solve the question by exclusively designating the nasal plate of the hindmost, the pterygoid bones, and the two other plates, the palatal bones. He says, "En dessous il y a aussi des particularités très-différentes des autres espèces. Les palatins occupent en longueur un beaucoup plus grand espace, et vont jusqu'à s'articuler en arrière avec les temporaux qui s'articulent aussi en un point avec les frontaux, de sorte que les pariétaux ne touchent pas aux palatins. Les apophyses pterygoïdes ou os pterygoïdiens forment, comme dans les autres dauphins, la plus grande partie du contour des arrière-narines, mais il me parait pas qu'elles se replient pour tapisser en dessous les sinus placés sous les narines; et même ces sinus, dans toute leur longueur, n'ont point de paroi inférieure osseuse et ne sont fermés en dessous que par des membranes; les parois inférieures des palatins laissant une grande solution de continuité dans toute leur crête inférieure. Les sinus communiquent amplement dans le squelette avec le réseau osseux de la face inférieure de crêtes maxillaires." (p. 299.)

Contrary to this view, according to which the said bones, consisting of three plates, which occupy the greatest part of the palate and extend quite to the temporal cavities, are made to represent by one of the plates the palatal bone and by the other the zygomatic bone, I must insist on their being altogether *pterygoid bones*. This opinion may, perhaps, be thought untenable, inasmuch as the zygomatic bones cannot be supposed to have such a large extension, least of all to reach so far as into the palatal cavity, where they seem to occupy the place of the large wings of the sphenoid bone; especially if the opinion, current in all the newest and best zoological manuals, and among them in that of Stannius*, that the pterygoid bones simply correspond to the inner wings of the sphenoid bone, is adopted. But it will be admitted, at all events, that it is rather the pterygoid than the palatal bones, which should be considered as occupying the place of the large wings of the sphenoid bone in the temporal cavities; and in the next place it should be borne in mind, that I have shown in the whalebone-whales, and expressly in the *Balænoptera rostrata*, that the ptery-

* Lehrbuch, &c. (Manual of the Comparative Anatomy of Vertebrate Animals). Berlin, 1846, 8vo, p. 366, *note* 14.

goid bone extends up to the temporal * and the parietal bones †; and that below, it covers the large wing of the sphenoid bone ‡, and forms even part of the basis of the cranium, namely the furrow for the fifth pair of nerves §. In other whales (such as the broad-headed, for instance, the Narwhale and *Delphinus globiceps*), the large wings of the sphenoid are only in part covered by the pterygoid; so that above, in the temporal cavity, they appear free between the frontal, temporal, and the parietal bones, as in man; although inwards, and in their greatest extent, they are here entirely covered by them; that is, in crania whose inner, very thin and fragile plate of the pterygoid bone is uninjured.

Cuvier's assertion that "les sinus placés sous les narines" are only closed below by a membrane, is perfectly correct, except that this membrane is throughout interwoven by a delicate bony net. Both these must be considered, further, as part of the plate of the pterygoid bone, and thus the remark of Cuvier, that the pterygoid bones in the Gangetic dolphin seem to him not to be recurved from below in order to cover the said "sinus" under the nostrils below, falls to the ground. It is certain, moreover, that the exterior bony or palatal wall of these "sinus" likewise belongs to the pterygoid bone. The same holds good with all other Cetacea and several mammalia not of that order. A bagshaped elongation proceeds sometimes from the cavity of the tympanum, or the Eustachian tube, towards the pterygoid bone. Where this consists of only one plate, as in the horse, it represents always the inner wing, and the bag is applied to its outer surface. But in *Bradypus didactylus* and *Myrmecophaga Tamandua* the bone consists of two distinct plates, leaving a cavity between them, into which the bag penetrates from behind. This is likewise the case in all whales, only that an extraordinarily thick, dense vascular net accompanies the bags, which, together with the tympanic cavities, are filled with blood and a number of strongyli; at least in the dead body. The proper entrance to these cavities, being the only one which, with its soft parts, is not closed up by any membrane, is always directed backwards, exactly against the petrous portion of the temporal bone and the bulla tympani. The *sinus* in question, under the posterior nostrils, belong, therefore, always and essentially to the pterygoid bones; and where they are situated outside these, as in the horse, the place of the outer plate is supplied by a membrane. But this does not prevent the excavation from penetrating deeper into the palatal bones, which actually takes place in dolphins generally (not

* Fifth Memoir on the Whales, p. 255, 256, t. 12. f. 3 *t*.
† Ibid. *b*. ‡ Ibid. *c*. § Ibid. f. 1 *u*.

in the whalebone-whales). Another and more substantial objection to my explanation of the bony structure of the Gangetic dolphin may, perhaps, be founded on this, that according to it, the palatal bones can hardly be pointed out. But, convinced on the one hand of the correctness of my account of the pterygoid bones, and on the other, of the necessity of the existence of the palatal bones, I have thought from the commencement, that they must be those parts of the palate which are marked *p* in Pl. VII. fig. 1; and I very soon satisfied myself, that they could not be the foremost elongated bones of the palate, which I have noticed above as plates belonging to the upper jaw-bones. It remains, therefore, only to account for the little three-cornered, very thin bony plate (also marked *p*) which appears on each side of the median line of the palate, between the upper maxillary and the pterygoid bone, as in the Hyperoodon. It is highly probable, that the plate forms only a small part of some bone, which conceals itself for the greatest part by the pterygoid bone; and I think even to have been able to discern, deep in the interior of the nose, that it forms the lateral sides of the nasal cavities, before the pterygoid bones. The real state of the case can only be decided by bursting a skull open.

Cuvier points out, that the crests between the basilar and lateral parts of the occipital bone ("crêtes du basilaire et des occipitaux latéraux") which inwardly confine the vault under which the ear is situated, are very thick and covered with minute bony spiculæ. The bulla tympani, he says, is very large and grown together with the petrous portion, which latter is not simply suspended (by means of fibrous tissue), but firmly wedged in between the temporal bone and the surrounding parts of the occipital bone.

This condition of the petrous portion, as pointed out by Cuvier, deserves some closer examination. In a preceding memoir (the sixth on Cetacea*) I have pointed out, that while that portion in the toothed whales, generally, is so loosely connected with the skull, that it commonly drops off during maceration; yet in some of the species, and in all whalebone whales, it sends forth a peculiar elongation, which enters between the temporal and occipital bones, and reaches in some even as far as the outer surface of the skull; its labyrinth being at the same time embraced, as it were, by protruding bony points of the temporal bone—by a single small bony hook in the Cachalot, according to the discovery of Peter Camper†. A similar structure exists in the

* Transactions of the Royal Danish Academy of Sciences, Fifth Series, Division of Nat. Hist. and Mathem., vol. i. Copenh. 1849, p. 94.

† Observations anatomiques sur la structure intérieure et le squelette de plusieurs espèces de Cétacés, publié par son fils Adrien-Gilles Camper,

Micropteron according to Dumortier*; and I have shown (*loc. cit.*) the existence of a similar hook in the Hyperoodon, preventing the petrous bone from falling off the cranium, even after it has become quite loose by maceration. When I wrote the memoir, I was not aware of the above statement of Cuvier, respecting the firm attachment of the petrous bone in our dolphin. On examining the specimen, in which (fortunately for my present inquiry) the tympanic bone had been knocked off from the petrous portion on both sides, this Camperian hook of the Cachalot showed itself so much developed, that for this reason alone the petrous bone, though quite loosened, especially on one side, could not possibly be detached without breaking the hook. In the smaller cranium, the elongation, which is wedged in between the temporal and occipital bones, does not quite extend to the outer surface; but in the larger specimen it appears to constitute part, at least, of the very rough and uneven bony protuberance, situated on the outside of the tympanic bone, and marked *t* in Pl. VII. fig. 1. In fig. 3. Pl. VI. it is still more distinctly seen, inclosed above by the temporal bone proper (*t*), externally by the jugular process of the latter, and internally by the lateral process of the occipital bone (*o*).

The basilar part of the occipital bone (Pl. VII. fig. 1*o*) is placed anteriorly, as in Cetacea in general; only it is free, has the form of a pointed wedge, and is foremost in the cleft of the posterior margin of the vomer; behind, it is situated between the two pterygoid bones. It exhibits, however, the greatest breadth between the petrous parts of the temporal bones, strongly excavated across (Pl. VI. fig. 3, under the articulating surfaces *k*) in such a way, that the lateral parts are curved like wings round the bullæ tympani, their obtuse margins being attached by means of strong fibrous cartilage. Between the pterygoid bone, the pars petrosa, and the temporal bone is formed the great aperture, which answers partly to the canalis caroticus and to the foramen lacerum anticum, but is otherwise connected with the large cleft which is prolonged anteriorly between the plates of the pterygoid bone. Pursuing this large aperture along the exterior margin of the bullæ tympani, a firm connexion is discovered with that surface of the temporal bone, which runs parallel with the pterygoid bones, and which, quite externally, at the point of transition into the root of the zygomatic process, is converted into a deep, round-oblong cavity, exactly behind the

avec des notes par M. G. Cuvier. Paris, 1820, 4to, p. 108, Atlas in fol. transv. t. 22–25.

* "Mémoire sur le Delphinorhynque microptère échoué à Ostende," Mém. de l'Académie Royale de Bruxelles, tom. xii. 1839, 4to, p. 10.

articulating surface for the under jaw. Immediately behind this cavity is the deep canal for the cartilaginous meatus auditorius; behind this again are two bony, obtuse processes, of which the foremost (Pl. VII. fig. 1 *t*) is the mastoid process of the temporal bone, and that behind, the so-called processus jugularis of the occipital bone, more correctly the hyoid process, because on it the cartilaginous os hyoideum is firmly grown. Between these two processes and the pars petrosa is the great foramen lacerum posticum for the transmission of the vena jugularis interna, together with the ninth, tenth and eleventh pairs of cerebral nerves, and, quite internally, in the semitubular hook between the hyoid process and the wing-formed lateral part of the basilar portion of the occipital bone (Pl. VI. fig. 3. before the bulla tympani *g*) for the twelfth pair. The condyloid processes of the occipital bone are equally bent upwards and downwards, so that they are equally conspicuous whether the cranium is viewed from above or from below. They are seen in their entire extension from behind (Pl. VI. fig. 3 *k*) on each side of the large, almost square foramen occipitale (*ibid. x*), whose inferior margin, however, is deeply excavated in the middle. A large aperture (foramen condyloideum posticum) is seen on the smaller cranium, above each articulating surface; on the larger cranium only above that on the right side. By throwing a strong light into the foramen occipitale, all the elevations and depressions, as well as the entire bony structure, may be seen on the inner surface, even in the unopened cranium. In most respects I can discover no essential peculiarities from other dolphins. The tentorium cerebelli is ossified only to a small extent; the falx cerebri more extensively. The posterior sphenoid bone seems to be one with the basilar part of the occipital bone, as is the ethmoid partially with the frontal and anterior sphenoid bones. The whole anterior cerebral cavity is formed of the frontal bones and partly the ethmoid bone; and the side walls of the parietal bones, between which is seen, above, a small interparietal bone. The temporal bones cannot be clearly made out. Besides the said large foramen occipitale and the two foramina lacera, together with the apertures on the pars petrosa temporum for the seventh and eighth pairs of nerves (not to mention in this place the so-called aquæductus), there are only three large apertures on each side. The foremost is situated between the anterior and posterior sphenoid bones; the middle one (proceeding backwards in the series) pierces their large wings; both are placed rather outwardly and are directed from behind forwards, through the pterygoid bone, and serve manifestly for the transmission of the chief branches of the fifth pair of nerves, answering to the foramina rotundum and ovale. The hindermost aperture is placed considerably outwardly between

the large wings of the sphenoid bone and the occipital bone; and it is at once evident, from this position of the foramina, and their very strongly developed processus clinoidei, that they serve for conveying the carotis cerebralis.

There is, besides, a large number of apertures on the inside of the skull, especially anteriorly in the frontal part, manifestly for the transmission of blood-vessels. The ethmoid bone rises in the median line in the form of a low, but broad crest (crista galli), having on each side some small holes, one on the left side, two on the right, large enough to admit a knitting-needle. Our dolphin, therefore, has most probably olfactory nerves like the Hyperoodon, contrary to what obtains in other species. There are two symmetrical, but not particularly large holes between the ethmoid and the wings of the anterior sphenoid bone, answering to the far greater holes in the same parts in whales generally. But the *most essential and remarkable feature in the cavity of the skull of the Gangetic dolphin* is this, that the *holes for the optic nerves are only rudimentary*. Indeed they are scarcely to be discovered except by a careful search assisted by their known locality and form. In size they are not at all larger than most of the other holes (for the transmission of blood-vessels) in the sphenoid and surrounding bones; they are much smaller than those in the frontal bone, and are to be recognized by their symmetrical position on each side of the base of the wings of the small sphenoid bones, but especially by their form of transversal fissures having the upper margin projecting. Only in the smaller of the crania which I had at my disposal, did I succeed in introducing a stiff hair through them into the orbits; and this most striking minuteness of the holes for the optic nerves, at once points out that the latter must be rudimentary in the Gangetic dolphin—a most remarkable circumstance.

The great similarity of the under-jaw with that of the Cachalot is very striking, both as regards its extreme narrowness and the consequent proximity of the two rows of teeth, and also the length of the symphysis, being little more than two-thirds of the whole under-jaw. Behind this long junction the side-branches diverge in a slightly curved direction (Pl. VII. fig. 1 *x*), the posterior half assuming the figure of a shovel, its upper margin rising for the insertion of the temporal muscle, and representing a much-elongated processus coronoideus, while its lower margin, which is slightly bent outwards, appears like a flat osseous wing on its outer third part (Pl. VII. fig. 1). The condyloid process is on the posterior margin, and like the side-branches, it is quite hollow, the entrance to their cavity, as is generally the case among dolphins, occupying nearly the whole posterior third of the inner plate of the branches.

The upper and lower margin of the symphysis of the lower jaw, viewed laterally, shows a gentle curve like the letter S; which is also the case with the upper jaw, though in a still less degree, as shown in Pl. V. In Cuvier's figure this curve is so strikingly marked, that I am almost led to infer, that it may have reference to the age or sex of the individual, especially as Mr. Gray represents it equally marked (Catal. p. 352). Both jaws project equally; the lower scarcely perceptibly beyond the upper. The anterior halves are about equally narrow, but from the commencement of the posterior half the upper jaw projects about 1''' beyond the lower, as far as the anterior margin of the crests of the upper maxillary bones (Pl. VII. fig. 1), where the side branches of the lower jaw begin to diverge.

The palate stretches much farther back in the upper jaw, so that the last pair of teeth do not meet the corresponding pair in the lower jaw (Pl. VII. fig. 1 *m*). Notwithstanding this, the number of teeth in the lower jaw is, at least, equal to that in the upper, namely twenty-nine on each side; while in the upper jaw there are only twenty-eight on the left side. The teeth in the jaws do not in consequence alternate in a quite regular manner, the first pair in the lower jaw being anterior to that above; the 17th being placed between the 16th and 17th pair above, though close behind the 16th. Both the 18th and 19th pair are between the 17th and 18th, and on the left side, the 21st and 22nd teeth stand between the 19th and 21st of the upper jaw, while on the right side the 22nd and 23rd below are between the 20th and 21st above; finally, the last (29th) pair in the lower jaw occupies, on each side, the space between the 26th and 27th pair in the upper. The length and form of the teeth vary much, though not by sudden transitions. The anterior are of considerable length (as much as 9'''), pointed, and so compressed and curved, that they have an anterior and posterior surface, an anterior convex and a posterior concave margin. Toward the middle of the jaws they gradually become shorter and cone-shaped, so that the 19th lower, and the 21st upper pair only project above the gums like little knobs, 1''' high, with broad bases. They then become again somewhat larger, especially in breadth. In proportion as they become shorter, they recede from each other in each of the four rows, while the two rows in each jaw approach nearer to each other; especially in the upper jaw, where the 19th and 20th pair come close up to the median line. In order, seemingly, to get room, the teeth alternate here to such a degree, that the upper 21st on the left side, stands right between the 21st and 22nd on the right, and this alternation continues quite backwards. In illustration of this description a figure is given (Pl. VI. fig. 2)

reduced only to *one-fourth** its original size; and in other respects I can refer to Mr. Gray's instructive figure (Illustr. p. 353). Anteriorly the lower teeth are seen to embrace as it were the upper jaw, leaving a deep furrow on the outer side of the opposed gum. Midway in the jaws, the apices of the teeth meet the corresponding gums, close to the outside of their own teeth, where they leave a small round impression; quite behind, the lower teeth project more than 1''' from the outside of the upper gums.

The os hyoideum does not differ from that in other whales. It consists namely, as is usual, of two arched cartilages; the posterior having three points of ossification—one in the middle (corpus ossis hyoidei), and one in each side-branch (cornua majora); the anterior having only one point of ossification in each side-branch, while the middle part, without ossifying, turns backwards on each side, towards the ossified middle of the posterior arch, on which it inserts itself (cornua minora). The ossification had not extended further in the posterior arch, than to leave a plate of cartilage, of the thickness of about 2''', between the middle part and the ossified part of the cornua majora, which were cartilaginous outside about one-fifth their length. The side parts of the anterior arch are cartilaginous inwardly about half their length, and outwardly towards their insertion on the occipital bone to about one-fourth of that extent.

Cuvier counted eleven pectoral vertebræ, assuming that twelve might possibly be the proper number. In M. Reinhardt's skeleton there are, however, only eleven pairs of ribs, and it is manifest that there never were more; because the 11th pair is attached both to the terminal margin of the transverse process of the 11th vertebra (Pl. V. fig. 2), and by the margin of its vertebral extremity, to the obliquely truncated transversal process of the next following vertebra, so that here, at least, no other rib could have had insertion. But Cuvier counted altogether only 46 vertebræ in his specimen, namely 7 cervical, 11 pectoral, and beyond these only 28 more. M. Reinhardt's skeleton counts 51 vertebræ, namely 7 cervical, 11 pectoral, 8 lumbar and 25 caudal. This great difference (between 46 and 51) cannot be taken as an individual one; and many zoologists would probably feel disposed to found upon it a specific distinction. But this latter could only be warranted, in case it were found that Cuvier's specimen too was perfectly complete; that the point of the tail wanted not even the last vertebra (which in M. Reinhardt's is a minute bony nucleus scarcely 2''' in diameter), and the other vertebræ were united by means of their natural liga-

* This refers to the figure given by the author: we have been compelled, in order to suit the size of the 'Annals,' further to reduce all the figures $\frac{4}{7}$ths.—Ed.

ments, or at least fitted into each other in such a way, as to exclude every suspicion of some intermediate vertebra being deficient. Until this shall be proved, we must be permitted to assume, that Cuvier's skeleton has wanted four or five, at least three vertebræ; it being no rare occurrence to meet with a difference of one or two in number in dolphins, but scarcely any greater, at least not where the total number is so small as in the Gangetic species. Throughout the spinal column there is the same difference in the bodies of the vertebræ as in other Cetacea, as to form and size, with this notable deviation, that those of the neck in general resemble more the Balænopteras than the toothed Whales, especially the Dolphins proper; being not only, as Cuvier remarks, "aussi distinctes que dans aucun quadrupède, et assez fortes bien que courtes;" but the two first are very strong, and each single one has its known character strongly pronounced. Thus, the axis, as compared with that in other whales, has its processus odontoideus strongly developed, and its convex articulating surface is turned more towards the head than the abdomen, while the middle of the anterior arch of the atlas forms a thick plate, which leans backwards on the processus odontoideus with a corresponding articulating surface. The bodies of the 3rd, 4th, 5th and 6th cervical vertebræ are small in breadth and height, but contrary to other dolphins, and in conformity with what obtains in whalebone-whales, the common lower transverse processes are strongly developed. Cuvier has already noticed this in these words: "Il y a un second rang d'apophyses transverses, partant du corps de la quatrième, de la cinquième et de la sixième. Ces dernières surtout sont plus longues que les véritables." I may add to this, that they are in reality found also on the third vertebra, the transverse process being so broad at its origin, that it stands in a line with the same processes both below and above, and has, besides, a foramen (though very small) forming in reality a ring, like the combined lower and upper transverse processes (Pl. V. fig. 2), which can only be considered as the bony parts of an otherwise cartilaginous or tendinous ring, which embraces on each side the arteria vertebralis, or that plexus of blood-vessels, which represents it in Cetacea. In M. Reinhardt's skeleton there is, on the left side of the seventh cervical vertebra, an inferior transverse process, but this is probably an individual deviation only (Pl. VII. fig. 4 *r*; *t t t* representing the upper, *o o*, the lower transverse processes of the sixth vertebra; which is likewise seen from behind, between the proper transverse processes, in fig. 3; *q* shows the lower transverse process of the fifth; *b*, *c*, the vertebral extremity of the first pair of ribs). The stout and strong transverse process of the second vertebra, which bends backwards and partly covers those following, must be considered as a combination of both processes,

even though imperforate; which is evident by its origin and position, as well as the exactly corresponding broad and large transverse process of the epistropheus in the whalebone-whales, having sometimes a very large, at others a very small foramen, indicating that the plexus of blood-vessels in the rings of the neck anteriorly, is sometimes greatly confined, at others not. The smallness of the foramen in the transverse process of the third vertebra in the Gangetic dolphin proves, that the plexus must be exceedingly confined anteriorly, or rather, that it escapes entirely from the annular sheath. The very strong transverse processes in the atlas are, contrary to what is the case in the axis, manifestly only proper or superior transverse processes. The marked curvature backwards of the transverse processes of the second vertebra, points to their use in the whalebone-whales; they serve for the insertion of a ligament for the first pair of ribs. The upper transverse processes of the fourth, fifth and seventh vertebræ are (as usual in mammalia and in man) cleft at the apex into two knobs, the inner more projecting, particularly in the seventh vertebra (Pl. VII. fig. 3 *x*). The arched parts of the vertebræ are widened transversely, especially in the sixth, which is particularly seen from the back, as compared with the narrow arches of the thoracic vertebræ (Pl. VII. fig. 3). From this view the second vertebra is strongly marked by its very broad and flat spinous process pointing backwards and upwards, and being elongated anteriorly, along the median line, in the form of a crest, projecting above the anterior margin. The other cervical vertebræ, on the contrary, have only a very slight crest in the middle, in place of the spinous process; their arched parts are generally very narrow, and their interstices proportionally large. Outwardly the dorsal part of each arch, as it passes into the ventral part and the body itself of the vertebra, is so much bent forward, that these parts get on a level with the dorsal part, not of the same, but of the vertebra next before. From the same curvature rise the two flat, rounded articular processes, the hindermost having the articulating surface pointing downwards and outwards behind the said curvature; the anterior upwards and inwards before the curvature (Pl. V. fig. 2, and Pl. VII. fig. 3, where the anterior articular process of the third vertebra is marked *a*; the corresponding posterior of the second, *p*). It is immediately under the anterior articular processes, exactly at the boundary between the dorsal and central portions, that the upper transverse processes, alluded to already, originate; they belong therefore entirely to the arched parts, while the lower belong to the body itself. The broad bases of the transverse processes in the second and third vertebræ belong therefore, according to what has been explained, both to the arched part and the body of those vertebræ.

Contrasting it with the last cervical vertebra, we now proceed to the first lumbar vertebra, after which we will consider the gradual transition of both these forms through the whole series of thoracic vertebræ. In comparison with each other the two sets are distinguished as usual, by the lumbar vertebræ having 1. the body and spinous process by far stronger; 2. the arched portions seated on a level with the body of their own vertebræ; 3. the processus obliqui seated on the arched portion at the origin of the spinous process; and 4. the transverse processes not only increased in size equally with the spinous processes, but at the same time moved down from the arched portion to the external obtuse margin of the body of the vertebra itself. It is unnecessary to explain further the manner in which the first point is gradually developed through the series of thoracic vertebræ; it may be seen in the figure (Pl. V. fig. 2). As regards the altered position of the arched portions, it may be accounted for by considering, that the gradually increasing size of the vertebræ from before backwards, is greatest before, in the spinous processes; behind, in the bodies. The third and fourth points, although the development is quite as in the Dolphins generally, seem to merit especial attention, on account of their having of late been considered as essential to the correct understanding of the vertebral processes in general.

In order to explain properly the above-mentioned third point, Prof. A. Retzius* has drawn attention to the necessity of distinguishing, as has been done already by a few older anatomists, between the two parts of which the so-called processus obliqui of the lumbar vertebræ may be said to be composed; namely the processus mammillares, and the real processus articulares. That this distinction is well-founded is clearly shown by the Gangetic dolphin, and perhaps all other Cetacea. On looking at the dorsal spine from above (Pl. VII. fig. 3), the series of processus mammillares is found to commence very decidedly with the fifth thoracic vertebra, close to the outside of the anterior processus articularis, though quite distinct from it (*a*) as well as from the processus transversalis (*t*) on which the tuberculum of the rib is attached (*c*). On the next following vertebræ, the anterior articular and the mammillary processes begin to approach each other more closely; the otherwise slight elevation of the former process at the same time gradually disappearing, so as to be seen already on the following fourth vertebra, only in the form of an oblong articulating surface, seated on the inside of the mammillary process itself. This structure might undoubtedly,

* Om Rätta tydningen, &c. (On the right explanation of the lateral processes of the dorsal and lumbar vertebræ in Man and Mammalia.) Transactions of the Royal Academy of Sciences of Stockholm, 1848, 2nd part.

as formerly, be expressed, by calling the mammillary process the articulating process; but this neither holds good in regard to the anterior portion of the dorsal spine, where the mammillary process suddenly makes its distinct appearance on the twelfth vertebra; nor behind from the beginning of the tail-part, where these articulating surfaces altogether disappear, and the so-called oblique or articulating processes lose their signification, and are nothing more than mammillary processes. The mammillary processes, with the anterior articulating surfaces and the isolated posterior articulating processes, appear gradually to move higher up, backwards, on the thoracic and lumbar vertebræ; and on the last lumbar the posterior articulating surfaces are actually placed on the root of the spinous process itself. But this is the direct consequence of the gradual change in the form of the bony arc, from a broad, low and depressed bridge across the spinal canal, to a narrow and high one (twice as high as broad, on the last lumbar vertebra).

The fourth point, however, has above all others attracted the attention of modern zootomists, in its relation to the vertebræ in mammalia. That the transversal processes (the upper or proper ones) belong to the bony arc, is by no means to be considered as a general rule; quite the contrary: they belong to the bodies of the vertebræ, from the hindmost thoracic, throughout the remainder of the spinal column, not only in whales, but likewise in many other mammalia, especially as regards a portion of the lumbar region*. Nevertheless, this difference in their origin, has long ago justly created doubts, as to their being entirely of the same signification. The transverse processes, which originate from the bodies of the vertebræ, could not be put on a level with the superior or proper ones; but rather with the lower processes of the cervical vertebræ. But in whales this view is opposed by the manifest uniformity among the transversal processes of the lumbar and the hindmost thoracic vertebræ, proceeding, besides, not from the arc, but from the body of the vertebræ; although it is to their apex that the hindmost ribs are attached, in which respect they appear, accordingly, not as the lower, but as the upper or proper transverse processes, both in the skeleton of the whale and of mammalia generally. The adoption of this view is rendered still more difficult in the *Balænopteræ,* on account of the want of neck and head in all the ribs, and the insertion of these on the top of the transverse processes, of which the anterior rise from the arc, the posterior from the body, the intermediate from both. Nevertheless, as after all the view in question is assuredly the correct one, its signification may be explained in the following manner, according to the homologies propounded by Stannius

* See Fried. Wilh. Theile, in Müller's Archiv, Jahrgang 1839, p. 108.

and Vrolik*, Owen† and Maclise‡. The ribs as well as transverse processes are to be considered collectively as fragments of common visceral or ventral arcs, each of which, in its complete state of development, has a twofold origin, or two roots: 1st, the ventral, from the body of the vertebra; and 2nd, the dorsal, from its arc (neurapophysis). The cervical transverse processes are the complete roots of visceral open arcs (that is, not reaching the medial line of the abdomen). The anterior thoracic arcs are always the most complete; their middle part (body of the rib) is connate with the ventral root (the neck and head of the rib) which is detached from the vertebra (in the *Balænopteræ* this root is quite tendinous or cartilaginous); the dorsal root (processus transversales), on the contrary, being connate with the vertebra, but detached from the middle part (the rib). In the series of thoracic vertebræ the two roots approach, and at last melt into each other (in the ninth in the Gangetic dolphin) at the point of transition between the arc and the body, the connate part of the arc (the transverse process) becoming at the same time proportionally shorter. In the last thoracic vertebræ (the tenth and eleventh in the Gangetic dolphin) it again increases in length, continuing in the lumbar vertebræ, but only as a ventral root (proceeding from the body of the vertebra), the arc portion is wanting altogether. The last pair of ribs is, therefore, exclusively attached to the transverse processes seated on the body of the vertebra; but these processes cannot be considered as homologous with those of the first thoracic vertebræ, but much rather with the necks and heads of the ribs.

On the other hand, if we compare the last caudal vertebræ with the lumbar, we shall find their difference not less marked, than what exists between the latter and the cervical vertebræ. We designate as the first caudal vertebra, that behind which is situated the foremost hæmatapophysis (Cuvier's "os en V"). It is the 27th in the column, and consequently one of the 33 vertebræ behind the 7 cervical and 12 thoracic; 8 being designated as lumbar and the last 25 as caudal vertebræ. In M. Reinhardt's skeleton there are 14 hæmatapophyses entirely, or in part only osseous; and as the first is situated between the 27th and 28th vertebræ, the last is situated between the 41st and the 42nd. I propose to distinguish this 42nd, and all the subsequent vertebræ, as *extreme*

* Natuur. en Ontleedkundige Beschouwing van den *Hyperoodon*. Transact. in Nat. Hist. of the Dutch Acad. of Sciences at Haarlem, 2 ser. vol. v. part 1. p. 34–40. 1848.

† On the Archetype and Homologies of the Vertebrate Skeleton. Lond. 1848, 8vo.—On the Nature of Limbs. A Discourse by R. Owen. Lond. 1849.

‡ In Cyclopædia of Anatomy and Physiology; edited by R. B. Todd. Part xxxv. Article SKELETON. London, 1849.

caudal, in contradistinction to the 14 anterior, or *caudal proper.* My reason for this distinction is, that, while in all the anterior, or proper caudal vertebræ, the processes of the lumbar vertebræ are still found to exist, with the exception of the articular, which we have noticed as disappearing already in the last; they are wanting in all the subsequent ones; and in lieu of them a new series of marked processes makes its appearance, developing itself gradually along the anterior caudal vertebræ. The bodies of these increase, accordingly, in thickness until the 7th; from thence they diminish again, most perceptibly so from the 12th. But the arc part, with the spinous and mammillary processes, diminish through the whole series, only a vestige remaining in the last, in the shape of a very small low bridge. It will be seen in the figure (Pl. V. fig. 2), that in this gradual disappearance, the spinous processes become proportionally broader (rather larger in the direction of their length) and the mammillary proportionally thicker, both at the same time moving more downwards.

Looking now to the hæmatapophyses, or the lower vertebral arcs, we find the first of these (between the 27th and 28th vertebræ), as so often happens in Cetacea, wide open, in other words, divided into its two lateral portions; and at the same time quite unsymmetrical. It is short and broad on the left side (Pl. V. fig. 2), its lower margin scarcely extending under the body of the next following vertebra; while on the right side it is not only placed somewhat more backwards, but its lower portion extends quite into and attaches itself to the second hæmatapophysis. The third is the longest; the succeeding ones decrease gradually, and the 14th, between the 40th and 41st vertebræ, appears only as a cartilaginous arc, $2'''$ to $3'''$ in height (surrounding the probably very small caudal artery), with an osseous nucleus in each side part. These hæmatapophyses, it is known, embrace the large caudal artery, which is an elongation of the aorta, a large branch of which ascends on both lateral surfaces of the body of each vertebra. This branch proceeds in the first eight caudal vertebræ behind the transverse process, in the five subsequent ones through it. Its furrow gets gradually deeper behind; the transverse processes in the meantime decreasing by degrees so much in height, that from the 9th to the 12th vertebræ they appear as a broken, but on the 13th as an entire little bridge. From the last proper caudal vertebra the arterial branch descends still deeper into the body of the vertebra. In the meantime two other lines of processes make their appearance in the caudal series of vertebræ, which I cannot consider as processus accessorii, although there exist no others which correspond to these. I propose terming them *processus caudales.* They have the

form of longitudinal crests, one being placed above, the other below the transverse processes. The upper series commences on the 5th caudal vertebra close above and behind the transverse process; it reaches higher up on the succeeding vertebræ, occupying their entire bodies, but becoming more and more deeply excavated for the arterial canal. The lower series commences in like manner on the 5th caudal vertebra, in the form of a terminating knob on the lower part of each canal, before and behind; but it gradually assumes, as it extends backwards, the shape of open arcs; and from the 12th, finally, of closed bridges.

Finally, the last eleven caudal vertebræ are of a cubical form, compressed backwards; each margin separating the four externally visible sides being distinguished by a round knob, which is nothing else than the said caudal processes. In lieu of the transversal processes, the side-surfaces are excavated; and on the four terminal vertebræ of the tail reappears again the vestige of a rounded transverse process, produced by the coalescence of the upper and lower caudal processes. The upper and lower surfaces are deeply excavated in the shape of a cross, longer from side to side, in consequence of the compressed figure of the vertebra being externally perforated for the arterial canal, which here traverses the whole side of the body of the vertebra.

Out of the eleven pairs of ribs the first four belong to the so-called true ribs. The eight foremost are attached between two thoracic vertebræ; the first between the last cervical and the first thoracic (Pl. VII. fig. 4 *b, c*), and anteriorly by a rather long cartilage to the excavated margin of the very large manubrium sterni. Since each of the seven following pairs is placed between two thoracic vertebræ, it has on each side a corresponding articulating surface. Only the three hindmost are seated on the transverse processes only. The lower or ventral extremity of the second pair is inserted by its long cartilage between the manubrium and the disproportionally small body of the sternum, which consists of two long side-pieces (that on the left side only half the size of the other); the third pair is attached between the body and the xiphoid, wholly cartilaginous process; and lastly, the fourth to each side of the posterior margin of that process. The lower end of all the succeeding seven pairs continues cartilaginous, and appears to lie loose in the flesh.

The shoulder-blade of our dolphin, Cuvier describes in these words:—" L'omoplate est beaucoup plus large qu'au dauphin " (*D. delphis*). " Son bord spinal est presque le double de sa hauteur. Son bord antérieur est simple " (wanting the fossa supraspinata) " et donne une apophyse, coupée obliquement, qui est l'acromion, et tout près de la face articulaire un petit tubercule à peine sensible, seul vestige de bec coracoïde."

It will be seen that our figure (Pl. V. fig. 2) answers quite to this description; there being a complete want of a proper articulation between any of the bones of the arm, hand and fingers; the arm, and especially the fore-arm, are very broad (the ulna broader than long), the six flat metacarpal bones connected like mosaic in two rows; and the immoveable fore-fingers arranged like a fan and causing the great breadth of the hand. Cuvier found only one joint in the thumb; in each of the four succeeding fingers four joints, and in the last two. On the specimen brought home there are two bony joints in the thumb, and four in each succeeding finger; but on each finger a terminal cartilage follows after the last bony joint, containing in the second, a little round bony nucleus. Hence, it is at least very probable, that in a full-grown specimen, the bony joints will be three for the thumb, and five for each remaining finger (on Pl. V. fig. 2, the cartilaginous nature of the last finger-joint is not particularly expressed).

[To be continued.]

XIV.—*Observations on the Olfactory Apparatus in the* Bullidæ. By Albany Hancock.

In our paper on the anatomy of *Eolis*, Dr. Embleton and I endeavoured to prove that in the nudibranchs the dorsal tentacles are the seat of the sense of smell; and if this be allowed, there can be little doubt that these organs, in all the other gasteropods, have a like signification. But in the *Bullidæ*, as no tentacles, properly so called, exist, it became a matter of some interest to ascertain if, with the apparent deficiency of these organs, all power of olfaction had ceased to be exercised. Being engaged at present in the investigation of the anatomy of some members of this family, my attention was naturally directed to this point; and I think I have obtained satisfactory proof that these hornless animals have really the sense of smell highly developed. The head lobe in the *Bullidæ* is, in fact, nothing else than the dorsal and labial tentacles fused into one continuous mass. This Cuvier asserted long ago; and it can very easily be proved on anatomical grounds. In this communication, however, I do not wish to enter at any length on the subject, as I intend at no distant period to give a detailed account of the anatomy of some of these animals. It may therefore suffice at this moment to state, that the nerves which supply the oral and dorsal tentacles in the gasteropods go to this lobe, the former to the anterior, the latter to the posterior portion of it;—a pretty clear proof of its real nature.

In *Gasteropteron* the head lobe, or more properly speaking the

tentacular lobe as designated by the great French anatomist, is largely developed, and the olfactory ganglions, the same as in *Doris*, *Eolis*, and several other mollusks furnish nerves to the dorsal tentacles, are not much less in size than the cerebroids themselves. They each give off two or three nerves, which passing backwards ramify on the skin of the under surface of the free margin of the lobe, reaching even to the posterior extremity. Hence it must be allowed that this part of the tentacular lobe is the homologue of the dorsal tentacles of other mollusks; and there is, therefore, reason to believe, that as in the tentacles so in this portion of the lobe resides the faculty of smell. The oral tentacular nerve supplies the anterior portion of the lobe, particularly the overhanging margin, by which touch would appear to be more decidedly exercised.

Olfaction becomes more specialized in *Philine aperta* than in *Gasteropteron*, and the olfactory ganglions are highly developed, of a branched form inclining outwards towards the sides of the head, and sending numerous twigs through the skin to the under surface of the tentacular lobe, where dividing and subdividing they are lost in an oval plate, of nervous matter, of a simple leaf-like form, which tapering forwards terminates in the oral lip. This oval plate, then, is the seat of olfaction in *P. aperta*. The stem-like continuation of it is, however, supplied with branches from the labial nerve, which arises from a large dendritic ganglion attached to the anterior margin of the cerebroid. This portion of the plate, therefore, probably performs some function in common with the lip—most likely that of taste; and if so, then in these mollusca the senses of smell and taste are intimately connected: and in this there appears nothing strange, when we reflect on the relationship that exists between these two senses in the higher animals. In *Gasteropteron* the labial nerve also sends branches to the under surface of the anterior portion of the tentacular lobe.

Akera bullata is likewise furnished with an olfactory plate or disc of an oval form, situated on the under surface of the tentacular lobe; but in this species it is coarsely wrinkled transversely, and its connexion with the lip is effected by a narrow belt which passes from about the middle of its superior or outer margin. The nervous element is here supplied from the same source as in *P. aperta*; only the labial and olfactory nerves have no ganglionic swellings.

It is, however, in *Bulla hydatis* that we see the olfactory organ most highly developed. In this mollusk it has attained a structure perfectly similar to what is observed in fishes, while at the same time it is a most instructive link, showing the analogy that exists between the dorsal tentacle of *Doris* and the olfactory organ

in this higher type of form. This organ in *B. hydatis* resembles in situation and general form that of *Philine aperta*; but instead of being a simple plate scarcely rising above the surface to which it is attached, it is composed of a central stem bearing numerous, considerably elevated, lateral laminæ. This beautiful organ escaped the observation of Cuvier, and appears to have been generally overlooked by naturalists. Mr. Wm. Clark gives a pretty full description of it in his paper on the *Bullidæ* in the 6th vol. of the 'Annals,' 1850; but seems to have entirely misunderstood its nature. He considers these "leaflets" salivary glands, or inclines to believe them such. They are not, however, glandular, are external, have no duct; and moreover well-characterized salivary glands exist in their normal position, supplied, as they always are, with nerves from the buccal ganglions. The fact that these leaflets receive their nerves from the olfactory ganglions is alone sufficient to explain their nature. These ganglions are of considerable volume, and are formed of nodulous branches, which penetrating the skin divide into numerous twigs; these go to supply the laminæ composing the leaflets. The anterior portion of this organ tapers into a stem-like prolongation, which is lost, as in *P. aperta*, in the oral lip; and here, as in that species, the prolongation is supplied with branches from the labial nerve. This nerve comes from the anterior margin of the cerebroid ganglion, and has in its course several ganglionic swellings*.

In this species, then, as well as in *P. aperta* and in *Gasteropteron*, taste and smell would appear to be connected. Be this however as it may, it is impossible to look upon this interesting modification of the olfactory organ in *B. hydatis*, and not see at once its similarity to that of fishes, and to the dorsal tentacle of *Doris*. It differs from that of the former only in not being inclosed within a cavity, though it lies protected and concealed in a groove; and its transformation into the tentacle of the latter can very easily be imagined. If the posterior portion of the tentacular lobe were divided down the median line, and the portions so divided raised up, the leaflets would then be seen on their posterior surface. It would now only be requisite to extend the laminæ round the sides of the elevated portions, and they would assume the appearance of the laminated tentacles of a nudibranchiate mollusk.

* As this paper was passing through the press, I have ascertained that *Acera aplysiaformis* is likewise supplied with an olfactory disc similar to that of *Philine aperta*; and what is of still more importance, that it has at each side of the mouth a well specialized organ of taste, both the labial nerves terminating in a bundle of filaments, the extremities of which pass to the surface of the skin.

XV.—*On a new British species of* Lepton.
By William Clark, Esq.

To the Editors of the Annals of Natural History.

Gentlemen, Norfolk Crescent, Bath, Feb. 15, 1852.

A new bivalve molluscum having occurred, I beg the favour of you to insert its specific characters in the 'Annals.'

Genus Lepton, Turton.

L. Clarkiæ (nova species).

L. testa fragili obliquo-subovali, compressa, postice et antice rotundata, albida, mediocriter nitida, striis concentricis, confertis, tenuibus notata; apices minutos, prominulos, subtilissime punctatos gerente. In valva dextra, utroque, dentes laterales, duplices, distantes apparent; sinistra, simplices; inter quos, utraque valva, dens unicus, primarius, erectus, acutus, oritur. Mensura obliqua $\frac{1}{11}$, transversa $\frac{1}{10}$, altitudo aut crassitudo $\frac{1}{40}$ unciæ. Zonam corallinam Devoniæ meridionalis, prope ostium Iscæ, rarius habitat. Animal ignotum.

Of this minute and elegant species, a series of eighteen perfect specimens have occurred, and having compared the hinge and dentition with forty examples of the *L. convexum* and *L. nitidum*, I can state that there is not the slightest variation in this respect in the three species. Its distinguishing characters are the almost perfect obliquely oval shape, being without a trace of the subangularity which is invariably seen at both extremities of the congeneric Leptons; and, as to the punctures, it is more devoid of them than the glabrous varieties of the *L. nitidum*, which however, in the forty specimens I possess, all show more or less the punctured aspect on the umbonal area; but in the *L. Clarkiæ* only the apical circumscribed space is in some, but not in all examples, almost invisibly punctured, which condition is rather more pronounced within than on the outside of the apices.

At one time I almost thought that the *L. nitidum* and *L. convexum* might march together as a single species, subject to many varieties; but an increase of my series of both has, at least for the present, made me doubt the propriety of considering the two as identical. The animal of the *L. convexum* is still unknown, and until it occurs, a safe determination on these points cannot be made. The animal of the *L. nitidum* I know well, having in the last summer observed two examples for four days; it only differs in some minor peculiarities from the *L. squamosum*, one of which I kept in sea-water thirty-four days, when it was killed whilst still vigorous, in consequence of my departure from the sea-side.

I may state, that in *L. Clarkiæ* the concentric striæ of incre-

ment are close-set and sharp, and sometimes broken into very short waved streaks; these in some of the specimens are crossed by gently raised lines of an intenser snowy-white than the general colour, which radiate sparingly from the beaks to the basal margin.

This delicate species cannot be confounded with any of the minuter bivalves: by its hinge it is essentially a *Lepton*: the nearest approach to any other species is to the *Montacuta bidentata*, which differs in form, colour and fragility, and in having the lateral dentitions almost close together, without the primary teeth between them; instead of which, there is a minute moveable ossicle, convex on one side and concave on the other, as in the *Anatinæ* or *Thraciæ*; this locks into a sloping pit that has sometimes the appearance of being ridged, which is only due to portions of the ruptured ossicle adhering to it; but in *Lepton* the primary teeth are persistent or integral parts of each valve. Fresh examples, new facts, and further investigation have all but convinced me that *L. convexum* and *L. nitidum* are distinct. Our Leptons, which I name according to rarity, will stand thus: 1st, *L. convexum*; 2nd, *L. Clarkiæ*; 3rd, *L. nitidum*; 4th, *L. squamosum*.

I am, Gentlemen, your most obedient servant,

WILLIAM CLARK.

XVI.—*Enumeration of some Fungi from St. Domingo.* By the Rev. M. J. BERKELEY, M.A., F.L.S.

[With a Plate.]

THE Fungi described in the present memoir were collected in St. Domingo by M. Augustus Sallé, and were placed in my hands by Mr. Hugh Cuming, from whom sets comprising most of the more interesting species may still be obtained. A good many kinds were represented by solitary specimens, but these, with one or two exceptions, are species which occur very frequently in tropical collections, especially from the neighbouring parts of America.

1. *Agaricus cepæstipes*, Sow. t. 2; Sallé, no. 15. On the ground. A single specimen only, which is not in a good state. The gills are not truly remote, but very finely attenuated behind, and the stem is not ventricose, resembling in this particular the variety described in the 'English Flora.'

2. *Agaricus* (Pleuropus) *catephes*, n. s. Pileo horizontali reniformi translucido glabro postice stipitiformi-attenuato; lamellis distantibus subdecurrentibus, interstitiis lævibus. Sallé, no. 12. On wood.

Pileus $\frac{1}{2}$–1 inch broad, delicate, translucent, quite smooth, regularly reniform, emarginate behind, and then attenuated into a short stem, which is fixed by a little round disc. Gills rather narrow, somewhat distant, subdecurrent, interstices even.

This species is very near to *A. limpidus*, but the pileus is regularly reniform, and the gills are not crowded. It is evidently more delicate than *A. mitis*, to which it bears some resemblance.

3. *Agaricus cerodes*, Fr. Ep. p. 195; Sallé, no. 13. On the ground.

4. *Agaricus* (Psalliota) *Sallei*, n. s. Pileo tenui campanulato squamuloso-furfuraceo acute umbonato; stipite tenui deorsum leviter incrassato; annulo submedio; lamellis remotis. Sallé, no. 14. On dead wood.

Pileus 3 inches across, thin, campanulate, furnished with a narrow but strong umbo; clothed with minute branlike scales. Stem 4 inches high, 2 lines or more thick, slender, slightly incrassated below, curved; ring deflexed, persistent, attached a little above the middle of the stem. Gills moderately broad, free, remote, leaving a large naked space round the top of the stem. Spores purple-brown, broadly elliptic, with one side nearly straight, $\frac{1}{2250}$th of an inch long, $\frac{1}{3000}$th broad.

This very fine species has exactly the habit of a *Lepiota*, to which tribe I supposed it to belong before examining the spores. Its nearest ally is *A. cretaceus*. It is curious that one or two undoubted *Psalliotæ* have white spores under certain conditions. This is indeed the case with *A. cretaceus*, which has, after examination of the spores, been sent to me as a *Lepiota*. *Ag. fumoso-purpureus*, Lasch, is another instance, and others might be brought forward.

5. *Agaricus campestris*, L.; Sallé, no. 25. On the ground. A small variety.

6. *Hiatula minima*, n. s. Minor; pileo umbilicato, margine crenato; stipite gracillimo; lamellis pauciusculis remotissimis. Sallé, no. 33.

Pileus $\frac{1}{3}$ of an inch broad, very delicate, umbilicate; stem 1 inch high, not a line thick. Gills about forty, narrow, sometimes forked, free, leaving a large orbicular naked space round the top of the stem, which has apparently no ring.

There is but a single specimen of this extremely delicate species, which is far less than the others. *Ag. discretus* and *Ag. Benzonii* are the types of the genus, of which *Hiatula fragilissima*, Ravenel, is a beautiful representation from South Carolina.

7. *Marasmius hæmatocephalus*, Mont. Fr. Ep. p. 382; Sallé, no. 1. On little twigs. A single specimen only.

8. *Lentinus villosus*, Klotzsch; Fr. Ep. p. 388; Sallé, no. 6, 7. On wood. Two specimens only which belong to two distinct

forms, the one much larger than the other, but agreeing in essential characters.

9. *Lentinus Lecomtei,* Fr. Ep. p. 388; Sallé, no. 3. On dead wood. A single specimen only, but probably common, as in all tropical countries.

10. *Lentinus tener,* Klotzsch; Fries, Ep. p. 389; Sallé, no. 5, 27. On dead wood.

11. *Lentinus Schomburgkii,* Berk. in Linn. Tr. vol. xx. p. 111. tab. 9. fig. 2. Var. lamellis glanduloso-punctatis, Sallé, no. 4. On dead wood.

I see no difference between the British Guiana and St. Domingo species, except the presence in the latter of spicules on the gills which are rather more broadly serrate.

12. *Lentinus eugrammus,* Mont. Cuba, p. 414; Sallé, no. 26. On dead wood. A single resupinate specimen.

13. *Panus connatus,* n. s. Cæspitoso-connatus: pileo plano demum depresso glabro lamellisque latiusculis integris decurrentibus pallidis; stipite tomentoso. Sallé, no. 8. On dead wood.

Pileus 2 inches or more across, smooth, at first plane or rather convex, then more or less depressed. Stems 1–2 inches high, $\frac{1}{4}$–$\frac{1}{2}$ an inch thick, more or less downy, striate, from the descending decurrent gills, which are rather broad and quite entire.

This species is allied to *P. conchatus,* but the stem is well developed and never obsolete. In very young individuals the pileus is convex with decidedly decurrent gills. In age the stem sometimes becomes lateral.

14. *Panus concavus,* n. s. Eximie cæspitosus: pileo infundibuliformi glabro; stipitibus centralibus glabris basi connatis; lamellis integris decurrentibus angustis; postice vix anastomosantibus. Sallé, no. 9. On wood.

Much tufted; pileus 1–1$\frac{1}{2}$ inch across, smooth, infundibuliform; margin arched. Stems 1$\frac{1}{2}$–2 inches or more high, about 1$\frac{1}{2}$ line thick, tufted, connate at the base, slightly attenuated upwards. Gills narrow, very decurrent, entire, scarcely at all anastomosing below.

This has very much the appearance of *Lentinus cæspitosus,* now referred by Fries, in his 'Novæ Symbolæ Mycologicæ' just published, to the genus *Panus,* but differing in its infundibuliform pileus. In the larger specimen the gills end in mere striæ on the stem.

15. *Schizophyllum commune,* Fr. Ep. p. 403; Sallé, no. 16. On wood. Extremely abundant, as in all tropical countries.

16. *Lenzites repanda,* Fr. Ep. p. 404; Sallé, no. 19. On dead wood. Small discoloured specimens.

17. *Lenzites striata,* Fr. Ep. p. 406; Sallé, no. 18. On charred wood.

No. 17 is, I suppose, a variety of the same species, specimens of which from Guiana were formerly distributed under the name of *L. brunneola*; but though thinner and more uniform in colour, I have since seen so many forms, that I am doubtful as to the stability of the species.

18. *Polyporus* (Pleuropus) *vinosus*, n. s. Pileo reniformi tenui zonato subtiliter velutino glabrescente vinoso; hymenio concolore, poris minimis hexagonis. Sallé, no. 43. On dead wood.

Pileus 2 inches across, 1 inch long, reniform, attached by a short disciform stem, which is sometimes more visible below than above, thin, rigid when dry and incurved, repeatedly zoned, of a dark vinous brown, very minutely velvety, at length nearly smooth, margin very thin and acute. Hymenium of the same colour as the pileus; pores very minute, but regularly hexagonal; dissepiments very thin, substance dark like the pileus.

A very remarkable species, to which I can point out nothing closely allied. When young it is paler and rather tomentose than velvety.

19. *Polyporus sanguineus*, Fr. Ep. p. 64; Sallé, no. 32. On dead sticks. One of the specimens shows very clearly that *Odontia miniata*, Berk. and Curt., is merely a resupinate state of this species, as pointed out to me since the publication of the supposed new Fungus, by Mr. Curtis.

20. *Polyporus* (Anodermei) *dorcas*, n. s. Pileo subreniformi postice affixo convexo crassiusculo crebri-zonato subtomentoso opaco cervino; hymenio umbrino; poris mediis irregularibus; dissepimentis subacutis rigidis. Sallé, no. 41. On dead wood.

Pileus $1\frac{1}{2}$ inch or more across, 1 inch long, subreniform, fixed behind by a broad disc, rather thick, convex, marked with numerous zones, which are sometimes raised, sometimes depressed, opake, not shining, minutely tomentose, slightly striate, of a pale fawn colour. Hymenium browner than the pileus, plane or slightly convex; pores irregular, often elongated and sinuated, about $\frac{1}{60}$th of an inch broad; dissepiments rigid, subacute, slightly toothed.

This species, though thicker, has somewhat the appearance of *P. Menziesii*, but has larger pores, by which character again it is at once distinguished from *P. brunneolus*, as also from *P. Cubensis*, with which it has a greater or less resemblance. It appears to be certainly undescribed.

21. *Polyporus cinnabarinus*, Fr. Ep. p. 473; Sallé, no. 29. On charred wood.

22. *Polyporus holosclerus*, Berk. in Hook. Lond. Journ. of Bot. vol. vi. p. 501; Sallé, no. 40. On dead wood.

23. *Polyporus versicolor*, Fr. Ep. p. 478; Sallé, no. 44. On dead wood. A pale form approaching *P. velutinus*.

24. *Polyporus velutinus,* Fr. Ep. p. 478; Sallé, no. 39 (in part). On dead wood. A few specimens intermixed with *Trametes occidentalis.*

25. *Polyporus elongatus,* Berk. in Hook. Lond. Journ. vol. i. p. 149; Sallé, no. 38. On dead wood.

The specimens are of a beautiful fawn-colour and a more shining aspect than others, but I am unwilling to separate them specifically. The figure of *P. flabellum* in the 'History of Cuba' is an exact representation of them, though my authentic specimens accord more closely with other samples of *P. elongatus,* which is a most widely diffused species.

26. *Polyporus* (Resupinatus) *vinctus,* n. s. Totus resupinatus, centro crassiusculus margine tenuis subliberatus supra sanguineotinctus; poris minimis pallidis contextu lignicolori. Sallé, no. 34. On dead wood.

Spreading for many inches over the decayed wood, 2 lines or more thick in the centre, very thin at the extreme margin, where the upper surface is separable, smooth, and stained with blood-colour. Pores scarcely visible to the naked eye, pallid, a line or more long; dissepiments thin; substance wood-colour.

I have no species in my collection at all resembling this. No. 37 is a form of the same species, with the whole substance thinner and the margin lobed. The liberated portions are not stained as in the thicker form.

27. *Trametes hydnoides,* Fr. Ep. p. 490; Sallé, no. 30, no. 72 (Mycelium). On dead wood.

28. *Trametes occidentalis,* Fr. Ep. p. 491; Sallé, no. 20, 39 (in part), no. 31 (forma resupinata). On dead wood. A very variable species, approaching in some of its forms to *Pol. hirsutus* or its allied species. The specimens with a spongy coat are nearest to the type; the others are rather referable to *P. velutinus,* as it occurs in tropical countries with a yellowish texture.

29. *Hexagonia variegata,* Berk. Ann. of Nat. Hist. vol. x. p. 380; Sallé, no. 21. On dead wood. A common species in Central America and neighbouring countries.

Characters of this species were not published in the place quoted above, because it was supposed by Dr. Montagne to be a form of his *H. aculeata.* Having however seen specimens from various quarters, I am now convinced of its being distinct, and therefore remedy the previous omission.

Pileo tenui coriaceo dimidiato rugoso crebri-zonato multicolori velutino; hymenio umbrino poris mediis.

Pileus 4 inches or more across, thin, coriaceous, rough with radiating wrinkles repeatedly zoned, with rich tints of chocolate-brown, chestnut, &c.; margin undulated or lobed, generally paler; clothed with short velvety down. Hymenium and substance

umber-brown, inclining to ferruginous; pores $\frac{1}{36}$th of an inch in diameter.

Nearly allied to *H. papyracea,* but that is very flexible, and has the pores about half the size of the present species. It is, like that, entirely destitute of fascicles of hairs. I have it from Jamaica, British Guiana, and Key West.

30. *Favolus induratus,* n. s. Pileo reniformi vertice affixo glaberrimo hepatico, demum indurato; poris subhexagonis magnis margine attenuato dentato. Sallé, no. 23. On wood.

Pileus $1\frac{1}{4}$ inch broad, 1 inch long, reniform, attached by the vertex, which forms a little round disc, liver-coloured, smooth, shining, depressed or convex, sometimes even, sometimes areolate from the contraction of the substance between the pores. Pores large, $\frac{1}{20}$th of an inch across, subhexagonal, sometimes projecting beyond the edge of the pileus, moderately deep; edge attenuated, toothed, paler than the pileus; in one specimen the walls are obscurely tomentose, but this is probably accidental.

This is a fine species approaching to the type of *Hexagonia,* and especially of *H. decipiens,* but evidently of a tough fleshy substance when fresh. The colour of the pileus is a rich liver-red. The margin in the largest specimen is slightly waved and lobed.

31. *Favolus tessellatus,* Mont. Ann. d. Sc. Nat. 1843; Sallé, no. 24. On dead wood.

The specimens are few and in bad condition, and scarcely represent the normal form of the species.

32. *Favolus cucullatus,* Mont. Cuba, p. 378; Sallé, no. 22. On wood. I have fine specimens of this species from South Carolina.

33. *Laschia delicata,* Fries, Ep. p. 499. *Laschia tremellosa,* Fries, Summ. Veg. Sc.!; Sallé, no. 64. On dead wood.

Laschia velutina, Lév.!, is the same thing, as is also the Brazilian Fungus in Gardner's Brazilian collection, which I have referred to *Exidia fusco-succinea,* Mont. Some specimens of *Exidia protracta,* Lév., approach very near to it.

34. *Irpex maximus,* Mont. Ann. d. Sc. Nat. 1837; Sallé, no. 28. On dead wood.

This species approaches very closely to some forms of *Polyporus hirsutus,* and the St. Domingo specimens are scarcely distinguishable from an authentic sample of *Pol. lutescens,* Pers., communicated many years since to Mr. Sowerby. The pores are not more unlike those of *Polyporus,* than those of *P. abietinus, pergameneus,* and many other species. Dr. Montagne, indeed, referred the plant to *Pol. labyrinthicus,* Fries, in his 'Fungi of Cuba,' but that species belongs to a very different section. I have therefore referred to the original description of the

species, leaving the task of giving it an appropriate name to the great French cryptogamist.

35. *Thelephora aurantiaca*, Pers. in Gaud. Uranie, Bot. p. 176; Sallé, no. 60. Amongst sticks, leaves, &c.

36. *Thelephora caperata*, Berk. and Mont. in Ann. d. Sc. Nat. Apr. 1849; Sallé, no. 59. On dead wood.

37. *Stereum damæcorne*, Fr. Ep. p. 546; Sallé, no. 53. On the ground amongst sticks, leaves, &c. A noble species

38. *Stereum nitidulum*, Berk. in Hook. Lond. Journ. Bot. vol. ii. p. 638; Sallé, no. 54, 55. On the ground and on dead wood.

The specimens are duller than those from Brazil, and scarcely so much zoned, but I am unable to distinguish them specifically.

39. *Stereum fulvo-nitens*, n. s. Pileo rigido tenui profunde infundibuliformi nitido creberrime zonato hymenioque lævi glabro fulvis; stipite brevissimo nigro. Sallé, no. 56. On dead wood.

Pileus coriaceous, thin, rigid when dry, deeply and regularly infundibuliform, 1 inch or more across and deep, shining, of a beautiful rich tawny red, marked with close zones of a slightly darker tinge finely striate; margin even, not plicate. Stem $\frac{1}{4}$ of an inch high, 1 line thick, blackish, dull, as if pulverulent. Hymenium even, smooth, bright tawny.

A very beautiful species allied to *S. elegans*, but distinguished by its regular form and brighter colours, especially that of the hymenium.

40. *Stereum elegans*, Fr. Ep. p. 545; Sallé, no. 57. On dead wood.

41. *Stereum petalodes*, n. s. Coriaceum; primitus infundibuliforme demum fisso-multipartitum; lobis striatis opacis subglabris; hymenio pallido rimoso. Sallé, no. 58.

Densely crowded, at first infundibuliform, soon split into numerous lobes, which are again more or less divided; dull reddish brown, marked with long grooves or striæ; hymenium pale, much cracked, sometimes so much so as to be granulated.

Allied to *S. involutum*, but much more split and lobed, with an obsolete stem and paler hymenium. The hymenium is not granulated from the beginning, but merely in consequence of the frequent cracking of the fructiferous stratum.

42. *Stereum fasciatum*, Fr. Ep. p. 546; Sallé, no. 52. On dead wood.

43. *Stereum papyrinum*, Mont. Cuba, p. 374; Sallé, no. 61, 81. On dead branches, St. Domingo and St. Thomas.

Thinner than in Dr. Montagne's specimens, but otherwise the same. The pubescence in the hymenium of *Thelephora crassa*, Lév., consists of brown ascus-like sacs, which, as far as I have

seen, seems to be the main distinction of that species. No. 62 is merely decomposed bark with a few scattered specks of the same fungus.

44. *Calocera divaricata*, Berk. Lond. Journ. Bot. vol. i. p. 140; Sallé, no. 70. Var. ramis magis erectis. On twigs, amongst leaves, &c.

The specimens are far finer than Dr. Hortman's, and have all the ramuli more erect, but I see no essential difference. The stem is divided from the base, and is clothed below with white down, as is indeed the case in the Surinam plant.

45. *Exidia hispidula*, Berk. in Annals of Nat. Hist. vol. iii. p. 397; Sallé, no. 63. On bark. I see no difference between this and *Auricularia lenta*, Fries!

46. *Exidia Auricula Indæ*, Fries, Ep. p. 590; Sallé, no. 79. On dead wood. Only two or three small specimens.

47. *Clathrus crispus*, Turpin, Berk. Ann. of Nat. Hist. vol. ix. p. 446. tab. 11; Sallé, no. 65. On the ground.

48. *Lycoperdon gemmatum*, Fr. Syst. Myc. vol. iii. p. 36; Sallé, no. 66. On the ground.

49. *Bovista cervina*, Berk. in Ann. of Nat. Hist. vol. ix. p. 447; Sallé, no. 67. On the ground.

Exactly according with Mr. Darwin's specimens from Rio Negro, Patagonia. The spores are very shortly pedicellate, and about $\frac{1}{6500}$th of an inch in diameter. In the St. Domingo specimens the orifice is strongly marked like that of the common *Tulostoma*.

50. *Stemonitis ferruginea*, Ehrenb. Silv. Ber. p. 26. f. 6 A, B; Sallé, no. 69. On dead leaves.

This seems to be exactly what Corda figures as *S. typhoides*. The spores are about $\frac{1}{3250}$th of an inch in diameter.

51. *Cyathus microsporus*, Tul. Ann. d. Sc. Nat. 1844; Sallé, no. 71. On branches of trees.

The spores of this species are much smaller than in others. My micrometer gives their longer diameter $\frac{1}{3250}$th of an inch, which is ·0078 mm.

Tulasne gives the measurement ·0066 mm. His specimens, like the present, are from St. Domingo.

52. *Aschersonia turbinata*, n. s. Stromatibus turbinatis sursum liberis excavatis deorsum connatis; sporis breviter fusiformibus. Sallé, no. 75. On leaves, generally confined to the upper surface.

Forming little scattered fascicles about 2 lines high, consisting of three or four turbinate bodies which are connate below, excavated above, even or granulated externally; margin acute, sometimes strongly plicate; disc more or less wrinkled and furrowed, studded with the orifices of the perithecia, which are sometimes

sunk in cracks, sometimes exposed. Perithecia oblong, occasionally confluent, narrowed above into a long neck, nearly colourless, consisting of delicate intricate threads, which pass into slender sporophores surmounted by short fusiform simple spores about $\frac{1}{2750}$th of an inch long.

The stroma consists of thickish threads which vary somewhat in diameter, and are loosely woven together towards the base, but closely packed towards the surface, and very frequently anastomosing, so as at last to form a dense, almost cellular substance. I have not observed any septa in the spores, but their absence will not justify me in separating this species from the other individuals of the genus. This is certainly one of the most curious species in the collection. It resembles at first sight small dried specimens of *Bulgaria sarcoides.*

53. *Uredo Domingensis,* n. s. Hypophylla; maculis nullis, soris sparsis orbicularibus epidermide persistente cinctis; sporis obovatis granulatis pallidis. Sallé, no. 78. On leaves of some unknown plant, probably a Solanad.

Hypophyllous; spots none; sori irregularly scattered, sometimes confluent, surrounded by the persistent epidermis; clinodium flat; spores oblong, $\frac{1}{850}$th of an inch long, $\frac{1}{1250}$th thick, pallid, granulated.

This appears to be a true *Uredo* according to Léveille's definition.

54. *Ustilago leucoderma,* n. s. Ambiens crusta dealbata tecta sporis atris opacis irregulari-subglobosis magnis filamentis paucis brevibus variis intermixtis. Sallé, no. 76. On the sheaths of some sedge.

Investing the successive sheaths in patches an inch or more in length, clothed externally with a white rugged crust. Spores $\frac{1}{1300}$th of an inch in diameter; black, subglobose, rather irregular, perfectly smooth, mixed with a few short variously-shaped transparent filaments or membranous fragments.

This species has much the habit of *U. hypodytes,* but is distinguished by its white crust and far larger and very different spores. Externally it has a very strong resemblance to *Ustilago typhoides,* Berk., but the spores are darker and exceed those of that species many times in diameter.

55. *Ustilago axicola,* n. s. Pilulæformis axim spicarum deformans; sporis subglobosis majoribus subpellucidis immixtis filamentis hyalinis. Sallé, no. 74. Infesting the lower part of the axis of the spikelets of some Scirpoid plant.

Forming little dusty irregular balls principally on the lower spikelets, and in these generally occupying the inferior portion of their axis. Spores about $\frac{1}{1800}$th of an inch across, globose, smooth, rather pellucid, with a distinct nucleus.

If a section is made through the axis the tissue is found to be entirely deranged, a few spiral vessels only being visible, and on the sides, which are very dark, perforated with a series of globose cavities, the whole of the darker portion being converted into a cellular stroma. Pellucid branched filaments traverse the cavities, and are mixed with and attached to the spores, sometimes in considerable numbers.

The nearest species to it is doubtless *Ustilago Montagnei*, from which it differs in its more globose and larger spores. Those of that species are $\frac{1}{2300}$th of an inch in diameter. When the spores of the two are placed together on the field of the microscope, there is a marked difference.

56. *Cephaleuros densus*, Kze.; Fr. Syst. Myc. vol. iii. p. 327; Sallé, no. 77. On coriaceous leaves.

57. *Peziza Domingensis*, n. s. Sessilis; cupula plana margine undulato, extus glabra pallida hymenio vinoso-fusco. Sallé, no. 42. Apparently on wood, but with mould attached to the base. St. Domingo and St. Thomas.

Cup 1 inch or more across, sessile or very slightly elongated and wrinkled at the base, externally smooth and even, pale salmon-coloured; margin undulated, at first somewhat incurved; hymenium of a rich vinous-chocolate. Asci cylindrical, very long, straight; sporidia elliptic, with two nuclei which are however mostly confluent.

Resembling somewhat small specimens of *Glœoporus conchoides*. It is very hard when dry. I cannot point out any closely allied species. Though not oblique, it seems to be nearest to such species as *P. onotica*, or perhaps to the two pedunculate species which follow.

The same species is probably presented also by no. 83, of which there is but a single specimen. At first sight it looks like a *Merulius*, but the veins merely arise from the contraction of the hymenium. This undoubtedly grows on wood.

58. *Peziza hystrix*, n. s. Cupula subglobosa cum stipite gracili setis longis cellulosis exasperata; sporidiis ellipticis apicibus apiculatis. Sallé, no. 35. On dead wood.

Cup $\frac{3}{4}$ of an inch or more broad, subglobose, with the margin strongly inflected when dry, clothed, especially towards the margin, with long stiff bristles, which are composed of numerous linear cells. Stem 1 inch high, scarce a line thick, flexuous, sparingly sprinkled with bristles like the pileus. Hymenium concave. Sporidia elliptic, pointed at either end. Endochrome scarcely bipartite. The colour of the whole when fresh is probably scarlet.

This species is closely allied to *P. sulcipes* and *P. Hindsii*, but distinguished from both by its long bristles. These do not, like

the bristles of *P. scutellata* and many other species, consist of a single row of cells, but are composed of a great many connate articulated threads. *P. tricholoma*, Mont., is smaller, and has the external surface costate.

59. *Peziza Hindsii*, Berk. in Hook. Lond. Journ. vol. i. p. 456; Sallé, no. 36. On dead wood.

This species closely resembles *P. sulcipes*, Berk., of which I have a specimen from Dr. Montagne marked *P. tricholoma*, but which does not at all accord with his figure or description. There are no anostomosing raised lines on the surface of the cup, and the bristles are very much shorter. *P. Afzelii*, Fr. Nov. Symb. p. 105; Afz. Ic. f. 50, is a smaller species of the same group.

60. *Hypoxylon vulgare* (*Sphæria Hypoxylon*, Ehr.), Sallé, no. 49. On dead wood. Abundant.

61. *Hypoxylon comosum*, Mont. Ann. d. Sc. Nat. 1840; Sallé, no. 51. On dead sticks. A single specimen.

62. *Hypoxylon obtusissimum*, n. s. Capitulo brevi late elliptico-clavato obtusissimo stipite brevissimo, cuticula fragili tenui, ostiolis minutissimis. Sallé, no. 47.

Head $1\frac{1}{2}$ inch long, nearly 1 inch thick, elliptico-clavate, very obtuse, covered with a thin brittle purple-brown coat, darker below. Surface smooth, with the exception of the extremely minute ostiola, which are scarcely visible to the naked eye. Stem extremely short.

This species has the habit of *H. allantoideum*, but differs in its very thin brittle cuticle and the much smaller ostiola. *H. zeylanicum* is far more rigid, besides being rather different in habit.

63. *Hypoxylon Domingense*, n. s. Maxima cylindrico-clavæformis deorsum furcata rigida laccata fusco-purpurea ostiolis prominulis asperula sursum involuta. Sallé, no. 46. On dead wood.

Heads cylindrico-clavate, 6 inches high, $\frac{3}{4}$ of an inch thick, forked below, hard, rigid, covered with a dull purple-brown, laccate, minutely cracked crust, involute above, slightly rough with the ostiola, which are visible to the naked eye. Stem distinct, about 1 inch high.

This magnificent species resembles closely *H. allantoideum*, but is more cylindrical, longer, minutely cracked and involute above. It resembles also *Hyp. fistulosum*, Lév., which has however more prominent ostiola and more regular obtuse heads. I do not know any other species with which it requires comparison. Its habit in its own section resembles somewhat that of well-developed specimens of *H. corniformis*, but stouter and more shortly stipitate.

64. *Hypoxylon grammicum*, Mont. Ann. d. Sc. Nat. Apr. 1840; Sallé, no. 45. On dead branches.

The specimens seem just intermediate between this and *H. rhopaloides*. Unfortunately I have no authentic sample of Dr. Montagne's plant, and therefore cannot speak positively. *H. rhopaloides* from Cuba and Surinam is far smaller. This is just the size of what Dr. Montagne figures, but is obtuse and not acute.

No. 50 is apparently a more slender and dwarf form of the same species.

65. *Hypoxylon concentricum* (Bolton sub *Sphæria*), Sallé, no. 48. On dead wood.

This is as strongly lacquered as *Hypoxylon vernicosum*, the essential character of which resides in the loose cellular character of its substance.

66. *Sphæria* (Circumscriptæ) *Sallei*, n. s. Orbicularis subangulata convexa; stromate atropurpureo; ostiolis longis subrugosis divergentibus basi velatis. Sallé, no. 82. On branches of trees.

Pustules 1–3 lines broad, orbicular, rather angular, immersed in the bark; stroma purplish black, extending over the base of the divergent, somewhat rugged, elongated, linear, subconical ostiola.

Unfortunately I have not been able to find any fructification in this fine species.

67. *Meliola amphitricha*, Mont. Cuba, p. 326; Sallé, no. 73. On leaves of some *Smilax*.

The following species of the collection are indeterminable:—

10. Some *Tricholoma* near *Ag. Columbetta* or *A. albus*.

2. Some *Naucoria*, abundant, but in the absence of notes I cannot say what species.

11. Some *Lepiota*, probably a new species allied to *A. illinitus*.

58. A single specimen of an imperfect *Marasmius*.

68. Mycelium.

80. Some fungus unknown. A single specimen without fructification.

EXPLANATION OF PLATE VIII.

Fig. 1. *a*, *Aschersonia turbinata*, nat. size; *b*, vertical section of stroma slightly magnified; *c*, section of perithecium and stroma magnified 250 diameters; *d*, spores; *e*, spores more highly magnified.

Fig. 2. *f*, section of *Ustilago axicola*, magnified; *g*, a portion of ditto more highly magnified; *h*, spores as seen under a power of 250 diameters.

Fig. 3. Spores of *Ustilago leucoderma* magnified to the same degree as (*h*).

Fig. 4. Spores of *Ustilago Montagnei* drawn to the same scale as (*h*).

XVII.—*Descriptions of two new British genera of Insects, and of two new species, belonging to the family* Curculionidæ. By John Walton, F.L.S.

Genus Trachodes, *Schüpp., Germ., Schönh.*

Char. Gen. "Antennæ moderate, rather slender; funiculus seven-jointed; the two basal joints obconic, the first stouter than the second, the remainder subnodose, very gradually increasing in breadth; the club short, ovate. Rostrum elongate, rather slender, round, linear and curved. Thorax truncate at the base and apex, rounded at the sides, and coarctate in front. Scutellum none. Elytra subovate, subtruncate at the base, the humeral angles subrotundate, attenuated towards the apex, moderately convex above."

Obs. Body ovate, convex, hispid, apterous, and of small size.

Trachodes hispidus, Linn., Germ., Schönh.
Rhynch. squamifer, Gyll.

Ovate, convex, fusco-piceous, hispid, clothed with depressed cinereous scales, and with erect scales. Head small, rounded, rufo-piceous, the vertex very convex and minutely punctured; eyes black, depressed; rostrum longer than the head and thorax, sublinear, slender, curved, rufescent, minutely punctate-striate at the base, smooth and shining towards the apex. Antennæ inserted a little behind the middle of the rostrum, rather thick, rufescent. Thorax subglobose, piceous, narrowed at the base and apex, rounded at the sides, somewhat convex above, pulvinated and closely punctulated; densely clothed at the sides with small cinereous scales and sparingly so on the disc, besides which there are two or four longitudinal rows of erect black scales. Scutellum none. Elytra ovate, very convex above, piceous, connate, attenuated at the apex, deeply sulcate, the sulci impunctate, the interstices indistinctly rugulose and alternately elevated; clothed with depressed cinereous scales, variegated towards the apex, forming, in recent specimens, a large cordiform fascia common to both elytra, and having likewise from six to eight parallel rows of erect black scales on the interstices. Legs elongate, rufescent; femora obscure, stout, clavate, each armed with a large acute tooth, and annulated with pale scales; all the tibiæ dilated at their apices similar to *Anthonomus Ulmi*. Length 2 lines.

I have a foreign specimen of this insect forwarded to me by the late M. Schönherr; at first sight it resembles *Acalles Roboris* of Curtis, from which however it widely differs in the form of the rostrum, the want of a pectoral groove, the length and form of the legs, and in having the femora armed and the tibiæ dilated.

T. C. Heysham, Esq., picked up a specimen eight years ago, of this remarkable and interesting insect, not far from Carlisle, which he kindly forwarded to me for my examination; since which another has been captured by Mr. W. Walker from the trunk of an oak in the New Forest, in May 1850; these I believe are all the specimens known to have been found in England.

Genus Acalyptus, Schönh.

Char. Gen. "Antennæ moderate, rather slender; funiculus seven-jointed; the two basal joints elongate, obconic, the first longer and stouter than the second, the remainder very short, truncate at their apices, coarctate, gradually increasing in breadth; club oval. Rostrum elongate, slender, linear, curved. Eyes lateral, rounded and slightly convex. Thorax bisinuated at the base, narrowed in front, a little rounded at the sides, and truncate at the apex. Elytra quadrate-ovate, rather convex above, regularly rounded at the apex; pygidium exposed."

Obs. This genus greatly resembles *Tychius* in its general habit, from which it chiefly differs in the structure of the terminal joints of the funiculus of the antennæ, in its linear slender rostrum, subdepressed body, and its sericeous piliform scales.

Acalyptus Carpini, Hbst, Gyll., Schönh.
— *sericeus* var. γ, Schönh. Supp.
— *rufipennis* var., Schönh.

Black, subdepressed, covered with shining silvery-white scales. Head small, suborbiculate, depressed, black, very finely punctured; eyes rotundate, brown, a little prominent; rostrum rather longer than the head and thorax, linear, curved, black, subopake, and very minutely punctured throughout. Antennæ rather short, slender, entirely pale testaceous; sometimes with the club obscure. Thorax scarcely broader than long, much narrowed in front, very little rounded at the sides, slightly bisinuated at the base, nearly flat above, black and closely punctulated; densely clothed with decumbent, piliform, shining, sericeous or silvery-white scales. Scutellum small, round, sericeous. Elytra much broader anteriorly than the base of the thorax, more than three times the length, the shoulders elevated, with the sides straight, each elytron regularly rounded at the apex, nearly plane above, black, piceous or testaceous, subremotely punctate-striate, the interstices flat, coriaceous; densely covered with scales similar to those of the thorax. Body black, punctulated beneath; the pygidium exposed; the breast densely, and the abdomen sparingly, squamous. Legs moderate, sparingly pubescent; femora robust in the middle, rufo-ferruginous, or totally pale testaceous; edentate. Length 1–1½ line.

Extremely variable in size and in the colour of the elytra; specimens occur of various shades from rufous to black.

The two foreign insects in the cabinet of Mr. Kirby sent by Gyllenhal, with the name "*Carpini,*" agree with British specimens. I possess a foreign insect from Dr. Germar named *Acalyptus rufipennis,* which I have no doubt is a variety of this, having pale elytra.

First discovered as a British insect by Mr. S. Stevens, who found it whilst beating the sallow blossoms, on the 28th of April, in a small wood near Fenny Stratford; to whose liberality I am indebted for specimens.

XVIII.—*On the* Cassidulidæ *of the Oolites, with descriptions of some new Species of that family.* By Thomas Wright, M.D. &c.*

[Continued from page 103.]

Genus Dysaster, Agassiz.

Test ovate or subdiscoidal; ambulacra simple, continuous and radiant; the posterior pair separated from the others, and converging to form a summit at some distance behind that formed at the apical disc by the antero-lateral pair and anterior single ambulacrum which gives value to the name *Dysaster.* Upper surface of the test smooth and convex, under surface much undulated from the convexity of the interambulacra and the straightness of the ambulacra. Tubercles small, mammillated and perforate, and surrounded by a circular depression; apical disc situated at the junction of the three anterior ambulacra, and formed of four perforated ovarial plates which are intimately soldered

* I have dedicated *Pygaster Morrisii* to my friend John Morris, Esq., one of the learned authors of a Monograph of the Mollusca of the Great Oolite.

After the first part of this paper was printed, I met with a specimen of *Hyboclypus caudatus* with the apical disc preserved *in situ,* which I regret was not found before the plate containing the details of the anatomy of that species was completed. The disc is formed of two small anterior ovarial plates, the right plate supporting the madreporiform body, and two larger posterior ovarial plates; between them and occupying the centre of the disc are four small rhomboidal plates, which probably represent the single ovarial plate composed of two valves, and the two posterior ocular plates displaced from their normal position in consequence of the posterior pair of ambulacra terminating in this genus at a short distance behind the apical disc; at the summits of the single and anterior pair of ambulacra are three small ocular plates with distinct eye-holes; the posterior ambulacra have no ocular plates at their summits; these elements according to my view are transposed to the centre of the disc to give greater expansion to the structure in this region.

to the adjoining portion of the test, and having the madrepori-form body on the surface of the right anterior plate; there are three ocular plates at the summits of the ambulacra with small eyeholes in depressions thereof; base concave and much undulated; mouth excentral, simple and pentagonal, situated near the anterior border; anus oblong or pyriform, marginal or submarginal, situated at the posterior surface, and sometimes encircled by the postero-lateral ambulacra.

Dysaster ringens, Agassiz.

Syn. ***Dysaster ringens***, Agassiz, Echin. Foss. Suisse, Part 1. p. 5. tab. 1. fig. 7–11; Agass. Cat. Syst. p. 3; Desor, Monograph des Dysaster, p. 24. tab. 1. fig. 13–17; Cotteau, Etudes des Echin. Foss. p. 46. tab. 2. fig. 10–13; Agassiz and Desor, Catalog. raisonné, A. S. N. tome viii. p. 33; Forbes, Mem. Geol. Surv. Decade iii. pl. 9.

Collyrites ringens, Desmoulins, 3rd Mém. sur les Echin. p. 368.

Dysaster Eudesii, Agassiz, Cat. Syst. p. 3; Desor, Monogr. des Dysaster, p. 23. t. 1. fig. 5–12.

Dysaster subringens, M'Coy, Annals Nat. Hist. 2nd Series, vol. ii. p. 415.

Test suborbicular or subpentagonal, rounded anteriorly, rostrated posteriorly; dorsal surface convex and depressed; sides tumid; vertex nearly central; ambulacra widely disjoined, posterior pair forming an arch above the anal opening; anus pyriform, marginal, and situated in a terminal sulcus; base concave, much undulated; interambulacra tumid, the single posterior area very prominent and much deflected; mouth small, subcentral and subpentagonal.

Height $\frac{7}{10}$ths of an inch, antero-posterior diameter 1 inch and $\frac{1}{10}$th, transverse diameter 1 inch. As this Urchin presents very variable proportions, we subjoin the following table of the dimensions of eight specimens from the Bridport Oolite by Professor Forbes* in inches and twelfths:—

	A.	B.	C.	D.	E.	F.	G.	H.
Length	$1\frac{1}{12}$	$1\frac{1}{12}$	$0\frac{11}{12}$	$0\frac{8}{12}$	$0\frac{19}{24}$	$0\frac{9}{12}$	$0\frac{10}{12}$	$0\frac{10}{12}$
Breadth	1	$1\frac{1}{24}$	$0\frac{11}{12}$	$0\frac{8}{12}$	$0\frac{8}{12}$	$0\frac{9}{12}$	$0\frac{10}{12}$	$0\frac{19}{24}$
Thickness ..	$0\frac{6}{12}$	$0\frac{8}{12}$	$0\frac{7}{12}$	$0\frac{5}{12}$	$0\frac{5}{12}$	$0\frac{5}{12}$	$0\frac{5}{12}$	$0\frac{6}{12}$

Description.—The preceding table of dimensions shows how much the general outline of *D. ringens* varies, being nearly orbi-

* Memoirs Geol. Survey, Decade iii. pl. 9.

cular, subpentagonal or oblong, with almost every intermediate form blending the two extremes in different individuals; the dorsal surface is uniformly smooth and convex, elevated posteriorly, gently declined anteriorly, and more or less depressed, the vertex being situated in general nearer the posterior than the anterior border; the sides are tumid, the anterior part is flattened, and the posterior is produced; the antero-lateral region is narrower than the postero-lateral; the prominence of the interambulacra in some individuals produces the subpentagonal varieties. The ventral surface is very unequal, the convexity of the interambulacra amounting to nodulose eminences; the posterior single area in particular is very gibbous, prominent, and much deflected; its posterior surface is truncated and channelled to form the anal valley, which is bounded by two ridges, commencing at the apices of the posterior ambulacra, and passing downwards and outwards towards the base, where they may be traced on the summit of the gibbous area as far as the mouth; in the upper part of the marginal valley and nearly on a level with the dorsal surface the anal opening is situated, having a pyriform shape, with the apex directed upwards. The ambulacra are of unequal width, the posterior pair being the widest; the anterior areæ are about the same width; the single ambulacrum is gently sinuous, the antero-laterals curve gracefully towards each other, and the three areæ converge at the apical disc near the centre of the dorsal surface; the posterior pair are somewhat wider than the others, they curve gracefully round the single interambulacrum, form an arch over its produced and truncated border, and converge above the anal opening; the ambulacra are all complete, and pass continuously from the mouth to the two dorsal summits; they are formed of pairs of small plates, about one-fourth the depth of the interambulacral plates, each plate being perforated at its outer side with two small pores; the ambulacra become wider about the mouth, and the pores increase in number, forming three oblique series of three pairs in each. The interambulacra are of unequal width; on the dorsal surface they are on a level with the ambulacra, but on the ventral surface they form nodulose eminences between them—so much so, that the ventral is as remarkable for its undulations as the dorsal is for the smoothness of its surface; the single interambulacrum being prominent and gibbous superiorly, posteriorly and inferiorly, but especially so in the latter region. The apical disc is a very curious structure, and is formed of two pairs of perforated ovarial plates, disposed in pairs, at some distance apart, and separated by three largely developed ocular plates which extend into the centre of the disc; the anterior pair of ovarials are of an irregular form, and separate the single ambulacrum from the antero-

lateral ambulacra; on the surface of the right plate is placed the madreporiform body; behind and between them is a small diamond-shaped plate occupying the median line, its anterior angle uniting with the apex of the single ambulacrum, and its posterior border with the anterior ovarials; behind these are two rhomboidal-shaped plates, which articulate before with the anterior ovarials, laterally with the apices of the antero-lateral ambulacra, and behind with the posterior pair of ovarial plates; near the points of junction of these plates with the ambulacra, the small eyeholes are situated; behind the rhomboidal ocular plates, the small oblong posterior ovarial plates are situated. I can detect no ocular plates at the summits of the posterior ambulacra; a fact, which in some measure serves to account for the concentration of the formative power on the three anterior ocular plates which exhibit such a disproportionate development in the apical disc of *Dysaster*. As this structure has not been accurately described by former observers, I have taken advantage of the circumstance of having before me a specimen most favourable for this purpose, and which I have carefully examined with the microscope under an inch object-glass.

The mouth is more or less subcentral, and lodged in a concavity; it is of a pentagonal form, and is about one-eighth of the length of the shell. The surface of the test is covered with small tubercles having punctated summits, and surrounded by a circular depression; they are larger on the ventral than on the dorsal surface, but are microscopic on both, and the intermediate surface of the plates is minutely granulated.

Affinities and differences.—Many of our specimens of this Urchin agree with the figures of *D. Eudesii* in M. Desor's monograph, whilst others have the depressed dorsal surface and angular outline of *D. ringens*, and as we have a series of intermediate forms connecting the extremes, it is probable that the former may only be a variety of the latter species. On this subject M. Cotteau* observes, that he collected with M. Moreau, from the "Oolite ferrugineuse" of Tour du Pré, a suite of specimens of *D. ringens* presenting various degrees of tumidity and more or less circularity of outline, and among which were all the gradations conducting to *D. Eudesii*, from which he concluded that the individual figured in his monograph, and which may be taken as a fair representation of many of our specimens, is a small and more elongated variety of *D. ringens*. This conclusion, according to Prof. Forbes†, is in accordance with the experience of the officers of the Geological Survey.

Locality and stratigraphical range.—*Dysaster ringens* var. *Eu-*

* Etudes des Echinides Foss. p. 48.

† Mem. Geol. Surv. Decade iii. pl. 9.

desii has been collected in the sands of the Inferior Oolite in Somerset and Dorset. Our specimens are from between Sherborne and Yeovil, Barton-Bradstock, Bridport, and Chideock Hill. On the continent it has been found in the "*Marnes Vésuliennes*" of the Jura by Agassiz, in the ferruginous Oolite of Normandy by Deslongchamps, and in the same stratum at Tour du Pré by Cotteau. Prof. M'Coy states that it is not uncommon in the Inferior Oolite of Leckhampton; but this is a mistake, as it is not within the experience of any of the local collectors, that a *Dysaster* was ever found in that locality; it is said however to occur in the Cornbrash near Cirencester, but we have not seen the specimens.

History.—*Dysaster ringens* was recorded for the first time by Agassiz in his 'Prodrome*,' and has been successively figured and described in his 'Echin. Foss.,' by M. Desor in his 'Monogr. des Dysaster,' by Prof. Forbes in his 'Memoirs of the Geological Survey,' by M. Cotteau in his 'Etudes des Echinides,' and was mentioned by Desmoulins under the name of *Collyrites ringens*.

Dysaster bicordatus, Desor.

Syn. *Dysaster bicordatus*, Desor, Monogr. des Dysaster, p. 9. tab. 2. fig. 1–4; Agassiz and Desor, Cat. raisonné des Echin., A. S. N. tom. viii. p. 31.

Dysaster symmetricus, M'Coy, Annals of Nat. Hist. vol. ii. p. 414, 2nd Series.

—— *Robinaldinus*, Cotteau, Etudes des Echinides, p. 75. tab. 7. fig. 1, 5.

Test thin, oval, anterior and posterior borders nearly uniform in convexity; sides tumid; dorsal surface convex, sometimes flattened; vertex excentral, situated near the anterior third; anus supra-marginal, postero-lateral ambulacra forming an arch over the anal opening; base convex, without undulations; mouth-opening small, situated at about the junction of the anterior with the middle third of the base.

Height at vertex $\frac{13}{20}$ths of an inch, antero-posterior diameter 1 inch, transverse diameter $\frac{9}{10}$ths of an inch.

Description.—The regular oval outline of this *Dysaster* forms a contrast to the orbicular and subpentagonal figure of *D. ringens* var. *Eudesii*; the sides are tumid, the dorsal and basal surfaces are smooth and convex, and the test has a uniformly gibbous appearance; the ambulacra are all complete, passing from the mouth to their terminations on the dorsal surface without interruption, and both on the dorsal and ventral surfaces being on a level with the interambulacral areæ; the three anterior ambu-

* Mém. de la Soc. d'Hist. nat. de Neuchâtel.

lacra converge about the anterior third of the back; the apex of the single anterior area is separated from those of the antero-laterals by the anterior pair of ovarial plates; the single ambulacrum is the narrowest, and the postero-lateral ambulacra are the widest; the anterior border is slightly flattened, and in the centre of this space the single ambulacrum passes in a straight line from the vertex to the mouth; at the apex of this area there is a small prominent subtriangular eminence which forms the highest point of the test, so that in this species the vertex is situated at the anterior third of the back, whilst in *D. ringens* it is in the posterior third; the antero-lateral ambulacra curve gently upwards, backwards and forwards from the mouth to the apical disc, forming thereby a gently undulated line; the postero-lateral ambulacra take a long sinuous course from the mouth, passing backwards, outwards and upwards over the posterior border, and converging near the median line above the anal opening, over which they form an arch; the apices of the postero-lateral ambulacra converge on the back at the distance of $\frac{9}{20}$ths of an inch behind the antero-lateral ambulacra; the pores are placed in oblique pairs, and are very distinct on the sides and back, but on the ventral surface they are small and very indistinct; in the specimens before me the interambulacral plates are large and bent, each forming a double inclined plane; the areæ are uniformly smooth and gibbous, the single interambulacrum is obliquely bevelled and slightly flattened, and at the extreme upper part of this area, nearly on a level with the dorsal surface, the anus is lodged; the opening has a pyriform shape with the apex directed upwards, from its lateral walls two obtuse ridges pass downwards and outwards; the basal portion of this area is a little more gibbous and produced than the other area. The ventral surface is convex with scarcely any undulation, anteriorly there is a slight concavity, and posteriorly an increased convexity occasioned by the gibbosity of the single interambulacrum; the mouth is lodged in a slight depression, the opening is small and subpentagonal, and is situated about the anterior fourth part of the antero-posterior diameter of the test; the exact relative situation of this aperture appears to vary in the different individuals I have measured. The apical disc is situated behind the subtriangular apical eminence, and therefore occupies the anterior third of the back; it has a lengthened rhomboidal figure and is formed very much like the disc in *D. ringens*, of which we have already given a detailed description; the four perforated ovarial plates and the three large curiously implanted ocular plates are seen very distinctly in the specimen before me; the right ovarial plate supports the madreporiform body. The elements of the disc are in general so entirely united with the ad-

joining pieces of the shell, that it is only in weathered specimens, or in those where the test has passed into the condition of calcareous spar, that we can distinguish the separate pieces of which it is formed. The surface of the shell is covered with small tubercles surrounded by circular depressions, between which numerous microscopic granules are scattered; the spines are unknown.

Affinities and differences.—In its general outline *D. bicordatus* resembles *D. ringens*, but is distinguished from it by the following characters: in *D. bicordatus* the highest point of the back is near the anterior third, whilst in *D. ringens* it is at the posterior third; in *D. bicordatus* the ventral surface is nearly uniformly convex, in *D. ringens* it is very much undulated; in *D. bicordatus* the apical disc is situated near the anterior third of the dorsal surface, whilst in *D. ringens* it is nearly central; the single interambulacrum is not so much developed, the anal opening is larger and higher up, and the anal valley is more rudimentary in *D. bicordatus* than in *D. ringens*. By its height and dimensions and the disposition of the ambulacra, and the high position of the anus and rudimentary valley, *D. bicordatus* closely resembles *D. Robinaldinus*. M. Cotteau however thinks it is distinct; but we have before us specimens from the Inferior Oolite so closely resembling the figure given by him in his 'Etudes des Echinides,' that we suspect Cotteau's species to be a variety of *D. bicordatus*. We have before remarked, that in our opinion a greater or less elevation of the dorsal surface or a flattening of the borders of the test do not *per se* constitute specific characters; for this reason we consider *D. symmetricus* as only an oval variety of *D. bicordatus*.

Locality and stratigraphical range.—This species has been collected with *D. ringens* by the officers of the Geological Survey from the sands of the Inferior Oolite of Dorsetshire. I have never had the good fortune to find it in the same stratum in Gloucestershire; it may however occur at Frocester and Wootton-under-Edge, where the sands of the Inferior Oolite attain a great development.

History.—First figured and described by Desor in his 'Monogr. des Dysaster,' afterwards by Cotteau under the name *D. Robinaldinus* in his 'Etudes des Echinides Fossiles,' and described under the name *D. symmetricus* by Prof. M'Coy; recorded as occurring in abundance in the Inferior Oolites of Dorsetshire by the officers of the Geological Survey.

Dysaster ovalis, Agass.

Syn. *Dysaster ovalis*, Agassiz, Cat. Syst. 3; Desor, Monogr. des Dysaster, p. 15. tab. 3. fig. 21–23; Agassiz and Desor's Catalogue raisonné des Echinides, A. S. N. tom. viii. p. 32.

Spatangus ovalis, Parkinson, Org. Rem. vol. iii. tab. 3. fig. 3; Phillips, Geol. of Yorksh. vol. i. p. 127. tab. 4. fig. 23; Young and Bird, Geol. of York. pl. 6. fig. 9.
Var. A. *Dysaster propinquus*, Agass. Echin. Foss. Suisse, i. p. 2. tab. 1. fig. 1–3; Desor, Monogr. des Dysaster, p. 14. tab. 3. fig. 24–26; Agassiz and Desor's Catalogue raisonné des Echinides, p. 32.
Var. B. *Dysaster truncatus*, Dubois, Voy. au Cauc. (Ser. Geol.) tab. 1. fig. 1; Desor, Monogr. des Dysaster, p. 17. tab. 13, des Galerites, fig. 8–11; Agassiz and Desor, Cat. raisonné des Echinides, p. 32.

Var. *major*. Height $\frac{19}{20}$ths of an inch, antero-posterior diameter 1 inch and $\frac{4}{10}$ths, transverse diameter 1 inch and $\frac{3}{10}$ths.

Var. *minor*. Height $\frac{13}{20}$ths of an inch, antero-posterior diameter 1 inch and $\frac{3}{10}$ths, transverse diameter $\frac{19}{20}$ths of an inch.

Description.—The general outline of this *Dysaster* is oval, the anterior border however forms the segment of a larger circle than the posterior border, which is produced and truncated; the upper surface is uniformly convex, the sides are tumid, and the base is flat; the ambulacral areæ are relatively wide, the anterior single ambulacrum and the antero-lateral ambulacral areæ converge at the apical disc, near the centre of the back; the single area descends in a depression which grooves the anterior border of the test, and the base thereof as far as the mouth; the antero-lateral ambulacra are gently sinuous, and form graceful curves over the sides of the shell, having their apices separated from that of the single area by the anterior pair of ovarial plates; the postero-lateral ambulacra are relatively wider than the antero-laterals, they take a straight direction at the base, are slightly sinuous on the sides, and converge at about the posterior third of the back, at a point about midway between the apical disc and the anal opening. The interambulacral areæ are formed of large plates, the single area is produced and sometimes truncated, and the anal opening is situated at the superior part of the posterior border between the point of convergence of the postero-lateral ambulacra and the basal angle.

The mouth-opening is excentral and lodged in a depression near the anterior border, about the anterior fourth of the base; the surface of the shell is covered with small tubercles, very uniform in size on the different parts thereof; the interambulacral plates are convex inferiorly and concave superiorly, whilst the ambulacral plates are united together by straight sutures; the pores are small and distinct, and more numerous in the avenues than in the preceding species; the apical disc is formed of four ovarial plates and three large ocular plates, the mode of arrangement appearing to resemble that described in *D. ringens*, but we cannot state precisely their structure from the condition of the test.

M. Cotteau observes that *D. ovalis* has been collected in the two divisions of the Oxfordian stage (département de l'Yonne), and in each it presents a distinct variety. In the ferruginous beds which repose upon the upper layers of the Bathonian stage it is of small size, and is flattened before, contracted behind, and almost flat above; in the Oxfordian limestones or upper division of this stage it is much larger in size, of a regular oval form, with more tumid sides: both of these varieties are figured in his work*.

Affinities and differences.—Adopting as we do the careful observations made by Agassiz and Desor on this species, who regard *D. propinquus* and *D. truncatus* as varieties of *D. ovalis*, these forms are readily distinguished from their congeners by the uniformly tumid oval form of the test. The large variety of *D. ovalis* however much resembles *D. analis*, but the former is distinguished from the latter species by the structure of the ambulacra; in *D. analis* the postero-lateral areæ converge immediately above the anal opening, whilst in *D. ovalis* their point of convergence is at some distance before that opening.

Locality and stratigraphical range.—This species was obtained by the Rev. Mr. Young † and by Mr. Phillips ‡ from the calcareous grit, and by the latter from the Coralline Oolite and Kelloway rock of Yorkshire. Its foreign distribution, according to Agassiz and Desor's Catalogue §, is from the "Argovien du Fringeli, Liesberg, Largue, Walen, D'Elemont, Purrentruy, Palins, Mont Brégille, near Besançon." It has been collected from the two divisions of the Oxfordian stage by M. Rashier, from the ferruginous beds at Gigny, and from the calcareous beds at Villiers-les-Hauts, département de l'Yonne ||.

History.—Our table of synonyms, to which we refer, gives the history of this species; it has been figured as a British Urchin by Parkinson, Young and Bird, and Phillips, in their respective works, but in all so badly that their figures are worthless; Agassiz has given beautiful drawings of the Swiss variety, and Cotteau indifferent ones of the larger and smaller varieties occurring in France.

[To be continued.]

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* Etudes des Echinides, p. 87.

† Geological Survey of the Yorkshire Coast, p. 215.

‡ Geology of Yorkshire, p. 134.

§ Annales des Sciences Naturelles, tom. viii. p. 32.

|| Cotteau, Echin. Foss. p. 87.

XIX.—*Observations on* Professor Lovén's *Homologies of Mollusca.* By J. E. Gray, F.R.S., V.P.Z.S. &c.

Professor S. Loven, in a very instructive paper on the Development of Bivalve Mollusca, in the 'Swedish Transactions' for 1848, published in 1850, has given a table showing his idea of the changes which the—1. *velum,* 2. eyes, 3. foot, 4. byssus, 5. pallial siphon, 6. shell, and 7. the internal plates of shells undergo in the different orders of Mollusca, and the organs which he regards as homologous to one another in the different orders. This paper contains many most interesting observations, showing very great research, and it must be considered as one of the most valuable contributions to the study of these animals which has been recently published; at the same time there are certain conclusions in it which are quite contrary to my own researches. As Professor Lovén has specially requested my opinion on them, I venture to state the reasons which induce me to dissent from them, hoping to elicit truth by the discussion.

1. Professor Lovén regards the *operculum* of the Gasteropodous Mollusca as homologous with the byssus of the bivalve; he describes it thus: "Byssus lamellis sæpe spiralibus coalitis operculum officiens."

In the 'Annals and Magazine of Natural History,' June 1850, I have given the reasons which induced me to believe the operculum to be the homologue of the second valve of the bivalve shell, and the opercular mantle the homologue of the second flap of the mantle of those animals. Further observation and comparison have only served to confirm my views.

In the latter part of the paper, which alone I profess to be able to read, there are no reasons given to show why Dr. Lovén regards the operculum and the byssus as homologous. I can only suggest two: first, that the operculum is often horny, and of the same horny consistence as the byssus; secondly, they are both placed on the foot. To these I must reply, that, though the substance of the operculum is also similar to the periostraca of the shell, and like the shell this horny part of the operculum is often covered with a shelly coat; and though the operculum and the byssus are both placed on the foot, they are situated in very different parts of that organ. The byssus is always placed on the hinder part of the lower edge; while the operculum is uniformly placed on the back part of its upper surface. There is also no similarity either in the œconomic use or in the development of these parts. The byssus is merely used to attach the animal to a particular locality; while the operculum is uniformly and only used to cover up and protect the animal when it is withdrawn into the shelly case. The byssus, which is only required

when the animal and shell are fully developed, is not formed until the animal has arrived at its full growth, and indeed is of so little importance in the functions of the animal, that it is sometimes not permanently present, but only generated when required; and it is often found in some genera of a family and not in others, and is sometimes even present and absent in the species of the same natural genus.

On the contrary, the operculum, like the shell, is always to be observed on the very young animal in the egg, and is always permanently attached to, and indeed forms as much an integral part of, the animal as the shell itself. I may further observe, that if the byssus of the bivalve and operculum of the univalve were homologous, they would not be found in the same animal, yet many operculated univalve and some inoperculated gasteropods have the faculty of forming a byssus which is secreted by the foot; and this byssus appears to be the exact homologue of the byssus of the bivalve. This byssus has been observed in the genera *Rissoa, Cerithium, Littorina* and *Litiopa,* all of which are provided with a well-developed operculum.

I may also remark, that the idea which I first proposed in Dieffenbach's Journal of New Zealand, in 1843, that the plug of the *Anomia* is only a modification of the byssus of the other Acephala, especially of the lamellar byssus of the *Arca,* has lately been proved by the examination of the animal, which shows that what has been considered as the muscles of the plug is really the foot of the genus. Mr. Forbes has more lately proposed the same theory, and compared the plug of the *Anomia* to the fibrous byssus of the *Pecten.*

If this is true of the *Anomia,* may not the tendon of the *Terebratula* be a modification of the byssus of the Conchifera, and the foot of that animal in its least developed state? Dr. Lovén does not allow of this homologue, for he describes the Brachiopodes as without any *byssus.* Dr. Lovén considers the appendages of the Brachiopoda which have been called the foot, like the arms of the Cephalopods, the papilla of the genus *Clio,* and the lips of the Acephala, to be modifications of the veil or *velum*; probably because they are all placed near or round the mouth.

Secondly, Professor Lovén observes, "The Cephalopodes, Pteropodes, Brachiopodes, and *Pectinea* have no pallial siphon; the Lamellibranchia Dimya have the branchial and anal often distinct; the Gasteropoda Prosobranchiata have the branchial often distinct, and the excretorial one rarely indicated, as in *Pleurotoma* and *Mangelia.*" To this I would remark, that in all the gill-breathing mollusca I have observed alive, let them be Gasteropoda or Cephalopoda, they have all had as distinct an in-going and outcoming current as the bivalve mollusca, generally situated in a

distant part of the mantle. In the spiral gasteropods the water enters by the front edge of the mantle, and is ejected at the hinder edge; the place where it is ejected is generally marked by a tooth or ridge on the hinder part of the inner lip of the shell, forming a canal with the outer lip; and sometimes the place of exit is marked by a more or less elongated canal on the shell, as in the genera *Ovula, Cypræa, Cassis,* &c. From the examination which I have made of the animal of *Pleurotoma* and *Mangelia,* I much doubt if this slit in the lip of the shell is used like the excretorial siphon of the bivalve mollusca, for the expulsion of the water which has been used in respiration. It may be used for the exit of the rejectamenta from the intestine, like the perforation in the shell of *Dentalium, Fissurella* and *Haliotis,* and the notch in the front of the shell in *Emarginula* and *Scutum.*

Thirdly, Professor Lovén regards "the cardinal teeth of the bivalves, and the apophyses of the hinge of Brachiopods, as probably homologous with the septa that separate the chamber of *Nautili* and the solid shelly matter which fills up the cavity of the shell of *Magillus.*" There is no doubt of the similarity of these parts, if we are merely to regard them as additional layers of shelly matter added to the shell; but if we are to consider their use in the œconomy of the animal, I cannot see any similarity between the cardinal teeth of the bivalves, and the shelly layers which diminish the size of the cavity of the shell. The former are used to keep the two valves of the shell in their proper relation to each other; and the latter, whether it forms a solid body as in the *Magillus,* or leaves certain spaces between each series of plates as in the *Nautilus,* is used for the purpose of letting the shell keep its proper relation with the body and head of the animal. The cardinal teeth of the bivalve appear to be the real homologue with the lobes on the operculum of *Neritidæ,* which keep the operculum in its proper relation with the shelly valve, and are analogous to the teeth, folds or ridges in the mouth, the grooves in the throat, and the folds in the pillar of certain spiral shells, which appear to be destined to keep the animal in its proper position in the cavity of the shell; and, like the teeth of the hinge, are formed by folds or loops of the mantle. It may be observed that many shells like the *Ostreæ* and *Mytili,* which have no true cardinal teeth, have more or less large eminences near the hinge or fold in the exterior margin of the shell, which serve the same purpose as the cardinal teeth in keeping the valves in their relative situation with regard to each other.

XX.—*Observations on the Affinities of the* Icacinaceæ. By John Miers, Esq., F.R.S., F.L.S.

[Continued from p. 132.]

One of the foremost of the conclusions last alluded to, is the necessity of removing the tribe of the *Icacineæ* of Mr. Bentham from the family of the *Olacaceæ*, for which many cogent reasons have already been offered (*huj. op.* viii. p. 173), and this group I propose to establish at once as suggested, either as a suborder, or more deservedly as a distinct family under the name above stated. In his excellent memoir on the *Olacineæ* before quoted, Mr. Bentham enumerated only eleven genera of that order, two of which were then first described by him. Of these five belonged to his tribe of the *Icacineæ*, and one I have shown has no relation there; hence only five genera out of that list were then known as really appertaining to the former family. I have now enumerated thirteen genera of the *Olacaceæ* (*loc. cit.* p. 172), and an equal number of the *Icacinaceæ* (*idem*, p. 174) *. This last-mentioned group exhibits characters so widely different from those of the former, that it becomes necessary to place the two at a considerable distance in the system. These characters consist in their frequently polygamous, almost diœcious flowers; the alternate position of their stamens with respect to the petals; the evidently normal polycarpellary structure of the ovarium (for where developed with more than one cell, the dissepiments are always found complete at their summit); the pendulous position of their ovules, generally two in each cell, near the summit, where they are suspended, one always more or less above the other, from a peculiar cupshaped podosperm; their constantly indutive seeds; the existence of a distinct testa, of inner integuments, of a chalaza and of a raphe: all these are important differences, quite at variance with the very peculiar points of structure that characterize the *Olacaceæ*.

With such completely irreconcileable characters, there is only one proper course to pursue, and that is to separate them; but it then remains to be considered, where in such case they should be placed in the system, for it is evident that they cannot even remain in juxtaposition. In the face of the difficulty of combating long-established opinions, it becomes essential, at the risk of the charge of prolixity, to recapitulate here a few of the arguments before assigned, in order to guide us to a right deci-

* One of these, *Ptychopetalum*, was placed here, because its ovules were stated to be attached to a parietal placenta; but having since had an opportunity of examining it, I find it to possess the general characters of the *Olacaceæ*.

sion. Proceeding upon the principle, that the most scientific basis for the distribution of plants is that founded on the characters which from their nature must be the most invariable, I mean those offered by the development of the organs of reproduction, we perceive a feature of most general occurrence, where the margins of the carpellary leaves are supposed to become placentiferous: sometimes these are believed to unite either by their edges and thus to form parietal placentations, or by the variable degree of their inflexion, to constitute either loculigerous or axile placentations; and from the evidence I shall be able to show, it will be evident that it is among the latter we must seek a place for the *Icacinaceæ*. But I have suggested the existence of several families, now distributed unsatisfactorily in different parts of the system, where we must imagine the placentæ to have originated, not from the *margins* of carpellary leaves which in such cases may be considered as sterile, but where their ovuligerous development is to be traced from the more basal or petiolar portions of the carpellary leaves: under this point of view, we may reconcile the idea of the original formation of an ovarium, which, though constituted of several carpels, will sometimes be unilocular, and at other times often incompletely plurilocular at the base, while in every instance they are all invariably 1-celled at the summit, the ovules being always attached to an erect placenta arising from the base of the cell, and completely unconnected with the style. This extensive group I have proposed to associate together in a distinct class, the *Cionospermæ* (*huj. op.* vii. p. 207).

It will be in vain to urge, that there exists only a slight difference in the structure of the plurilocular ovarium with axile placentation, and the one-celled ovary with central placentation: this has been contended by several able botanists, who have argued that in such cases the dissepiments have been originally complete, but that by their attenuation they have broken away, until they have left the placentary column free. I do not deny that under certain circumstances this sometimes happens, but in such cases we can always trace the indications of such rupture, and we also invariably find, that the axile column, rendered thus free in the middle, is always attached by its summit to the style. On the other hand, in *Myrsinaceæ*, we cannot discern any indication of parietal expansion, or the smallest involution of what we may conceive to have been the sterile margins of the carpellary leaves; we find there the ovules often crowded around a free globular placenta, rising but little above the base of the cell, and springing directly from the pedicel of the flower: here, at least, we have fair evidence, that both placentæ and ovules must have proceeded from an immediate expansion of the elementary petioles

of the original carpellary leaves. We perceive indeed, among the *Cionospermæ*, a gradual deviation from this extreme, beginning with slight parietal rudiments of sterile dissepiments, about the base of the cell, and varying in degree, until we reach the oppositely extreme cases of the *Styraceæ* and *Humiriaceæ*, where the ovarium is many-celled, even to the apex; but even here, in spite of the converging and always thickened incomplete dissepiments, extending so far, as even almost to touch the central expansions, we find the ovuligerous placentæ in the axis, always quite free from them, and from the style. If no original difference is to be found in the nature of the development, between the plurilocular germen, and the one-celled ovarium with free central placentæ, or if the existence of the latter were due to the breaking away from the placentæ of the inflected portions of the dissepiment so formed, we should sometimes perceive in the same order, the same genus, or even in the same individual, some instance where this had happened in a greater or less degree, and we should often meet with the two structures confounded; but we find invariably an equally uniform amount of development, proving that in their normal origin they are distinct.

It was upon these views I drew the conclusion and offered the suggestion (*huj. op.* vol. viii. p. 167) that the nearest affinity of the *Icacinaceæ* is with the *Celastraceæ*, or the *Aquifoliaceæ*, but that they differ from these in many essential respects, and cannot be held to be subordinate to either of them. With those who think it tends to the simplicity of the science, to diminish to the utmost possible extent the present number of natural orders, the *Celastraceæ*, *Aquifoliaceæ*, *Icacinaceæ*, *Hippocrataceæ* and some others might be considered as suborders of one large family; but I do not perceive any advantage in this method; for it matters little whether such divisions be called classes and orders, or orders and suborders; for were such an order established (under the name, for instance, of the *Dryaceæ*), it is clear that, in practice, any plant traceable to such alliance would always be referred to its own peculiar suborder and never to such family. I therefore incline to the greater convenience of retaining each group as hitherto established, as a distinct order, and combining the whole in a class that may be called the *Dryales**, because they mostly consist of trees with evergreen leaves. They cannot consistently be retained in the class of the *Frangulaceæ* of Endlicher, which are marked by other very different characters.

The group of the *Dryales* will hence consist mostly of evergreen trees with alternate, rarely opposite, exstipulate leaves

* From δρῦς, *arbor sempervirens*.

which are generally coriaceous, entire, or slightly toothed; symmetrical flowers mostly hermaphrodite, often polygamous; calyx small, campanulate, toothed, free, or sometimes conjoined with the ovarium by the intervention of a fleshy disk; stamens generally equal in number to the petals, and then always alternate with them, usually five, rarely fewer, and often arising from a conspicuous disk; ovarium 5-locular, often by abortion only 3-, 2- or 1-celled; ovules anatropal, often resupinated, generally two in each cell, attached by a cupshaped podosperm to the axis or dissepiment, and either erect, horizontal, or suspended; seeds often solitary in each cell, frequently with a conspicuous arillus; embryo orthotropal, albuminous, or rarely exalbuminous, with the radicle pointed towards the hilum.

The families that at present appear to constitute this group may be distinguished from each other by the following leading characters:—

Æstivation of Corolla.	Stamens in number to petals.	Disk.	Ovules.	Seeds.	Embryo.	Family.
imbricate.	equal.	present.	erect or ascending.	albuminous.	with large foliaceous cotyledons.	Celastraceæ.
,,	,,	,,	suspended.	,,	short with small cotyledons.	Aquifoliaceæ.
,,	fewer.	,,	horizontal.	exalbuminous	fleshy with thick or foliaceous cotyledons.	Hippocrataceæ.
unknown.	equal.	,,	suspended.	,,	fleshy.	Chailletiaceæ.
valvate.	equal.	rarely obsolete.	,,	albuminous.	either small or large foliaceous cotyledons.	Icacinaceæ.
imbricate.	,,	none ?	,,	,,	small cotyledons.	Cyrillaceæ.

The *Icacinaceæ* may be thus defined. Trees or shrubs with alternate entire petiolate leaves, generally more or less coriaceous, smooth, exstipulate. Flowers hermaphrodite, or polygamous by abortion, generally very small, and very simple and symmetrical in their structure: inflorescence axillary or terminal, fasciculate or in many-flowered cymes or branching panicles, each flower distinctly articulated upon a short bracteated pedicel; bract minute, either very caducous, or abortive. Calyx usually small, cupshaped, 5-, rarely 4-toothed, persistent. Corolla hypogynous, consisting of 5, rarely 4 petals, alternate with the teeth of the calyx, always distinct, though often connivent at base into a tubular form by the slight adhesion of the filaments, more or less linear, of fleshy texture, valvate in æstivation, with the apical points inflected, reflexed and deciduous. Stamens equal in number to the petals, always alternate with them, and

nearly equal to them in length; filaments erect, often implicated, fleshy, compressed, subulate, sometimes invested with glandular hairs; anthers introrse, 2-lobed, 2- or 4-celled, cells dehiscing lengthways by a cleft along one of their margins, rarely otherwise. Ovarium entirely free, supported upon a cup-shaped disk (which is either quite free or partially adnate with it), fleshy, oblong-conical, often surmounted with a conspicuous fleshy epigynous gland, which is sometimes lateral, generally by abortion 1-locular, sometimes 3-locular, and then the cells are excentrically disposed, showing the normal number of united carpels to be 5: ovules geminate, somewhat collaterally suspended, one a little higher than the other, from near the summit of the cell, by a short fleshy podosperm, which is generally expanded in the form of an inverted cup, anatropal, and sometimes resupinate. Style erect, or incurved, somewhat excentrical, as long as the stamens, sometimes wanting. Stigma generally clavate or obsoletely lobed. Drupe baccate, containing a single 1-celled, indehiscent putamen; seed single, filling the cavity of the cell, and apparently resupinate; testa thin and somewhat membranaceous, raphe arising from the nearly basal chalaza and extending to the summit along the dorsal face. Embryo in the axis and summit of fleshy and copious albumen, sometimes much shorter, and almost terete, with small oval cotyledons scarcely longer and broader than the superior radicle; but often nearly the length of the albumen, with large, ovate, foliaceous cotyledons, much longer and broader than the short terete superior radicle.

The affinity of the *Icacinaceæ* is evidently nearest to the *Aquifoliaceæ* and the *Celastraceæ*, differing from both in the æstivation of the corolla and the tenuity or frequent obliteration of the hypogynous disk. From the latter family they are distinguishable by their suspended ovules and their generally unilocular ovarium, and the absence of an arillus about the seed. The seminal characters have been derived from examinations of the seed of several species of *Mappia*, and confirmed by the few details furnished by the 'Icones' of Dr. Wight in tab. 1153 of *Apodytes*, and tab. 934 of *Stemonurus* (*Gomphandra*). I have little hesitation in concluding that the genus *Pennantia*, which has been placed by botanists in many different positions, belongs to this group, and from this source I am enabled to add many additional features which will probably be found to exist in the structure of other genera of this family.

I propose to divide the order into three tribes.

1. *Icacineæ*. In all the genera composing this tribe, the ovarium is constantly unilocular in consequence of the complete abortion of the other cells, hence it is always somewhat gibbous and the style is distinct and in some degree lateral: the anthers

are 2-lobed and 4-celled. This tribe will consist of the genera *Icacina, Apodytes, Rhaphiolepis, Mappia, Desmostachys, Leretia,* and *Poraqueiba*.

2. *Sarcostigmeæ*. These differ from the preceding tribe, in the absence of a more or less elongated style: here the true style, seen only in a young state of the ovarium, consists in a broad, depressed, conical and more or less hollow process, having a very small apical aperture, which is terminated by 4 or 5 extremely minute stigmatic teeth: with the growth of the ovarium, this assumes a more fleshy, broader, and more discoid appearance, and the stigmatic teeth become less visible, the whole soon taking the form of a depressed, 4–5-lobed, sessile stigma. The ovarium and fruit, in their structure and development, resemble what is seen in the former tribe; the stamens are also equal in number, and alternate with the petals, and the anthers are likewise 2-lobed and 4-celled. This tribe will consist of *Pennantia, Stemonurus, Sarcostigma, Discophora,* and probably also *Phlebocalymna*.

3. *Emmoteæ*. This at present is only represented by a single genus, *Emmotum* of Desvaux, which is certainly identical with *Pogopetalum* of Bentham, and which differs from all the others in its plurilocular ovarium, and the singular structure of its anthers, which are 2-lobed, and consist of 2 unilocular, evalvate and boat-shaped pollen-cells attached to a cordate and apiculate connective, fixed extrorsely upon the reflexed point of the filaments in the sinus of its anterior face, the pollen escaping by the splitting of the dorsal margin of each valve from the posterior surface of the connective, along the whole line of its attachment; they vary also in having an ovarium with three cells laterally placed in the manner before mentioned. These peculiarities, so very opposite in character to the features we invariably meet with in the other tribes, very naturally suggest a doubt as to the propriety of retaining this genus in the order; but no satisfactory conclusion on this head can be entertained, until some information be obtained respecting the structure of the fruit and seed.

I take this opportunity of remarking, that I have lately examined with attention the features of several genera newly proposed and described by Prof. Blume, in his 'Mus. Lugd. Bat.,' and referred by him to the *Olacaceæ*. Among them is *Nothapodytes* (*loc. cit.* p. 248), which will be seen to conform in all respects with *Mappia* (Jacq.), a genus shortly to be described at length. The characters given of his *Pleuropetalum* (*loc. cit.* p. 248), by the same distinguished author, will easily be recognized as those of *Bursinopetalum* of Dr. Wight, placed by that eminent botanist in *Olacaceæ*, but which I have shown must be referred to *Aquifoliaceæ*, it being nearly allied to *Villaresia*: having to describe in the sequel some new species of both these genera, I will then

take an opportunity of pointing out the identity above mentioned. *Anacolosa* was first proposed as a second section of his genus *Stemonurus* by Dr. Blume in his 'Bijdr.' p. 648: more recently, he has with ample reason elevated it to the rank of a separate genus (*loc. cit.* p. 250), with the important addition of analytical details of its structure, in tab. 46 of the same work. The facts there demonstrated prove beyond doubt, that they must constitute not only very distinct genera, but that they must be referred to different families. *Anacolosa* will consequently find its place among the *Olacaceæ*, and it is rendered more interesting, as bearing considerable resemblance in some of its characters to *Cathedra* (*huj. op.* vol. vii. p. 452) with which the *Diplocrater* of Mr. Bentham (Hook. Kew. Misc. iii. p. 367) will be found to be identical. *Stemonurus*, as an unquestionable member of the *Icacinaceæ*, will therefore be shortly investigated here. The genus *Platea* of the same botanist, first proposed in his 'Bijdragen,' and of which more ample generic details are given in his 'Mus. Lugd. Bat.' p. 249, appears to me to differ in no essential respect from *Stemonurus*: the stamens in this last-mentioned genus vary considerably in length, not only in different species, but often in the same individual, according to the age of the flowers; the number and length of the villous hairs that clothe the summits of the filaments are not less variable; in some cases these hairs are almost obsolete and scarcely discernible, so that the stamens are reduced to the state of those described in the male flower of *Platea*, which differs in no other respect from *Stemonurus*: the female flowers also agree in all essential points with those of the genus last-mentioned, where, owing to the extremely caducous disposition of the petals and stamens, we often find, in several species of *Stemonurus*, just what is described in the character of *Platea*. As *Lepionurus* does not belong to the *Icacinaceæ*, I shall defer making any observation on that genus, until we come to treat of the genera of the *Olacaceæ*.

Icacina.

This genus, which, as the first discovered, may be considered as the type of the family to which it belongs, was founded by Adr. de Jussieu in 1823, upon a plant from Senegal, bearing much the habit of *Chrysobalanus Icaco*, whence the derivation of its generic name. It was arranged by DeCandolle in his 'Prodromus,' i. 534, as a genus "*Olacineis* affine," and subsequently was placed in the same family by Mr. Bentham, as the type of his tribe *Icacineæ*. I may here remark, that in the young state, the stigma is distinctly 3-cleft, and the style is short, erect and straight as in *Mappia*; it is owing to its elongation while yet in bud, that it becomes incurved, and to pressure against the petals, that its

stigma becomes obsoletely lobed. It is the only species hitherto described, for the *Icacina dubia* of McFadyen will be shown to be the *Mappia racemosa* of Jacquin. Three other species will, however, be added below. The generic character may be thus given.

ICACINA, A. Juss.—*Flores* perfecti. *Calyx* breviter campanulatus, 5-dentatus, dentibus acutis, persistens. *Petala* 5, oblonga, intus villosa, extus sericea, hypogyna, æstivatione valvata, sub anthesi patentia, imo adhesione filamentorum in tubum brevem conniventia. *Stamina* 5, cum petalis inserta, iisdem alterna; *filamenta* carnosula, imo dilatata, apice subulata, et breviter induplicata; *antheræ* ovatæ, introrsæ, 2-lobæ, 4-loculares, imo ad medium bifidæ, connectivo tenui adnatæ, dorso in sinu affixæ, lobis singulatim 2-locellatis, demum septicidis et longitudinaliter evolutim* dehiscentibus. *Pollen* acute 3-gonum. *Ovarium* liberum, oblongum, sub-gibbum, villosum, disco parvo suffultum, 1-loculare; *ovula* 2 juxta apicem loculi subcollateraliter superposita, podospermio crassiusculo suspensa, anatropa. *Stylus* elongatus, subulatus, sulcatus, incurvus. *Stigma* obliquum, obsolete lobatum, lateraliter excavatum. *Drupa* villosa, monopyrena, 1-locularis, monosperma; cætera ignota.—Arbores *in Africam tropicam vel in Insulas vicinas crescentes*; folia *alterna, ovata, integra, coriacea, petiolata, exstipulata*; inflorescentia *paniculata, terminalis*; flores *parvuli, cum pedicellis brevibus articulati*, bracteolis *minimis, caducis*.

1. *Icacina Senegalensis*, Ad. Juss. Mem. Soc. Hist. Nat. i. 173. tab. 9; DC. Prodr. i. 534; Guill. Perr. Tent. Fl. Seneg. i. 105. Chrysobalanus luteus, *Sab. Trans. Hort. Soc.* iv. 453;—foliis ovatis basi rotundatis a medio acuminatis et apice obtusis, vel rotundatis et retusis, reticulatis, coriaceis, utrinque glaberrimis, supra sub-lucidis, subtus ferrugineis, petiolo brevi crassiusculo canaliculato: floribus terminalibus, laxe paniculatis, pedicellisque articulatis rufescenti-villosis; drupa flava. —Senegambia; *v. s. in herb. Hook.* (Heudelot).

The figure above quoted of Jussieu gives a very good repre-

* I shall continue to use this term to prevent a repetition of the following mode of dehiscence, which I find nowhere described, although it is of frequent occurrence: it differs essentially from the longitudinal or valvate opening of the ordinary simple cell, in the same manner that the septicidal dehiscence of a capsular fruit does from its loculicidal mode of opening. The structure of its 2 lobes and their manner of dehiscence may be further defined—lobæ introflexione marginum contiguorum singulatim parallele et perfecte 2-locellatæ, marginibus istis primo solutis, valvulis tunc contrarie evolutis; dein apparet ut si lobæ ambæ 1-loculatæ fuerint, et per rimam longitudinalem dehiscerint.

sentation of this plant, and the specimen in Sir Wm. Hooker's herbarium agrees very well with it, except that the leaves are generally more rounded at the summit, and deeply emarginated; but it agrees in all its other characters. The leaves are $3\frac{1}{2}$ inches long, $2\frac{1}{4}$ inches broad, on a petiole scarcely 2 lines in length; the internodes are 1 inch distant, and the raceme is 2 inches in length, on the elongated termination of the branch.

2. *Icacina Mauritiana*, n. sp.;—arbor 7-orgyalis, ramulis glabris foliis oblongis, utrinque acutis, apice acuminatis, glaberrimis, subtus ferrugineis, margine revolutis, petiolo subtenui; panicula terminali folio longiore, pluriflora, ferrugineo-pubescente, floribus albis, odoratissimis.—Mauritius; *v. s. in herb. Hook.*

This is a tree 40 feet in height, growing near Colville Bridge; its leaves are $2\frac{1}{2}$ inches long, $1\frac{1}{8}$ inch broad, on a somewhat slender petiole half an inch in length; its terminal panicles are about 2 inches long. It appears to me referable here, rather than to *Apodytes*, because of the induplicated apex of its filaments, and the form of its anthers, which are shorter, more ovate, and less bifid than in that genus.

3. *Icacina grandifolia*;—foliis cuneato-oblongis, apice obtusis, infra medium attenuatis, utrinque glaberrimis, concoloribus, multinerviis, margine undulatis, petiolo brevi crasso canaliculato; panicula terminali laxe ramosa, ramis longe nudiusculis, apice floriferis, multiflora, folio longiore.—Madagascar; *v. s. in herb. Hook.* (Lyall).

This is a very distinct species, remarkable for the large size of its leaves, which are 6 inches long, $2\frac{1}{2}$ inches broad, on a petiole only $\frac{1}{4}$ of an inch in length; the terminal panicle is 8 inches long, with its virgate branchlets 4 to 5 inches in length, which are ramified towards their extremity and bear numerous small pubescent flowers*.

BIBLIOGRAPHICAL NOTICES.

The British Species of Angiocarpous Lichens, *elucidated by their Sporidia*. By the Rev. W. A. Leighton, B.A. London: Printed for the Ray Society, 1851.

The present volume is to be regarded as one of the most valuable contributions to European Lichenology which has been made for some years. It is, in fact, the only work with which we are acquainted which supplies analytical figures of any considerable group of Euro-

* A drawing of this species with generic details will be given in plate 4 of the 'Contributions to Botany.'

pean lichens. The plates in 'English Botany,' however excellent and characteristic, are almost without exception void of all microscopical dissections. The same remark is to be made concerning the recent publication of Dietrich. Mr. Leighton has given figures of the sporidia of those British Lichens which are comprised in the division *Angiocarpi* of the immortal work of Fries on the European Lichens, and has accompanied them by descriptions and a selection of synonyms. So far as we can judge, the task has been on the whole faithfully and admirably executed: and if we venture to notice a few points which appear capable of improvement, it is mainly with the hope that Mr. Leighton and the Ray Society may take them into consideration in bringing out plates and descriptions of other families of the British Lichens, expectations of which are held to us in the commencement of the present treatise. To proceed to the work itself. In the introduction, Mr. Leighton gives an historical account of the attention paid to the asci and sporidia by preceding lichenologists, showing them to have been known even so early as the time of Micheli and Dillenius, but not to have received much attention until a very recent period. "The only writers who have devoted anything like attention to the subject," he says, "are Eschweiler and Fée" (p. 2). Without in the least undervaluing the labours of the learned writers here mentioned, we must remark that Mr. Leighton has, unintentionally of course, made important omissions. Dr. C. Montagne, whose cosmical aquaintance with Lichens is probably greater than that of any botanist living, has rarely omitted to take notice of the forms of the *asci* and *sporidia* of those lichens which he has figured and described both in the 'Annales des Sciences Naturelles,' and more particularly in his magnificent 'Cryptogames de Cuba.' His observations have moreover in many cases been very successfully applied to distinguish allied species which had been confounded by Eschweiler or other writers. It is unnecessary, we conceive, to prove this. Nor should the labours of Flotow, in various papers in German Transactions, have been passed over in silence; one at least of which is exclusively devoted to this very subject (Botanische Zeitung, 1850, May 3 and May 10).

Mr. Leighton was supplied by Mr. Borrer with the original specimens of the Lichens figured and described in 'English Botany,' with many valuable notes which he has printed, and with authentic specimens of many species described by Dr. Taylor; as well as with various rarities from other friends, particularly from the Rev. T. Salwey. So far therefore as specimens of British Lichens are concerned, the present work leaves little to be desired; but we must express our regret that the author did not furnish himself with the 'Lichenes Helvetici Exsiccati' of Schærer, a work which can readily be procured, in order to ascertain the identity or non-identity of Schærer's species with his own (p. 78). We do trust that this defect will be remedied in Mr. Leighton's forthcoming treatises: if the specimens of Mougeot's and Nestler's 'Stirpes Crypt. Vogeso-Rhenanæ' were likewise referred to, the value of the work would be increased. The synonyms of the English writers are tolerably complete; the foreign lichenologists

are somewhat more sparingly quoted: we would suggest that references should be made constantly to Tuckermann's 'North American Lichens.' The dissections were made under an excellent microscope by Messrs. Powell and Lealand; and we have no doubt that the appearances which presented themselves have been faithfully transmitted to us in the present volume. We are sorry, however, to be unable to speak of the execution of the plates with unqualified praise. The lithography is very coarse, and in some cases the letters attached to the figures are almost illegible (see plate vii. and xxiv.); the colours also are frequently *smeared* upon the plates. We trust that better care will be taken with those which follow, and we venture to hint at a few improvements which may be made in them. It would be desirable that the *ascus* should in *all cases* be figured, where its form can be discovered: and if the size of the drawings were reduced considerably, much expense would be saved and no practical advantage would be lost. Whenever the species of lichen, whose analysis is given, had never been figured, or was ill-figured, a representation of the plant of the natural size might be very profitably annexed.

We will now say a few words on the literary execution of the work. It would have been a great improvement if Mr. Leighton had given specific characters of the Lichens in every case, so that a botanist might be able to determine a specimen from his work, without continually having recourse to other books. To take an example. The only information given respecting the thallus of the first six species of *Endocarpon* (*E. miniatum, leptophyllum, euplocum, lætevirens, psoromoides* and *pulchellum*) is "thallus foliaceous subpeltate;" although the thallus alone immediately distinguishes several of these species from each other. Again, between *E. miniatum*, Ach., and *E. leptophyllum*, Ach., no distinction whatever is drawn, the description of the sporidia running in exactly the same words for each. According to our notions, indeed, *E. leptophyllum* is only a dwarf form of *E. miniatum*, with which Fries associates it; and this view is much confirmed by Mr. Leighton's discovery, that the analysis is the same for both. Had the work been constructed on a different plan, a small additional amount of labour and expense would have made it a portion of a History of British Lichens, instead of its being simply a very valuable supplement to other works, and one which can only be employed by a person in some degree acquainted with his subject.

Mr. Leighton is considerably more inclined to divide species than ourselves, and in some cases constructs them out of scarcely sufficient materials. Thus we should hardly have distinguished *Chiodecton albidum*, Leight., from *C. myrticola*, Fée (pl. viii. ix.); or *Verrucaria codonoidea*, Leight., from *V. margacea*, Wahl. Still less certainly does it appear to us prudent, in so very difficult a genus, to describe a new species of *Verrucaria* (*V. linearis*, Leight.) from the portions of the plant which grow on the Borrerian specimens of *V. Dufourii* (= *V. Borreri*, Leight.). The plant, it seems, resembles *V. Dufourii* in almost everything except in the smaller size, and in the differently shaped sporidia. These sporidia appear to us to be in all likelihood simply the young or abortive ones of *V. Dufourii*: different enough

in appearance from the normal form, but having in themselves a very suspicious shape. How much caution should be employed in using the shape and subdivisions of the sporidia will be evident from the following passage of Montagne's 'Cryptogames de Cuba' (p. 154):—"Malgré la forme en apparence dissemblable sous laquelle se sont présentées les sporidies à M. Fée et à moi, je ne puis me persuader que mon lichen . . . . . soit une espèce différente. *Cela n'a rien de surprenant pour qui a analysé un grand nombre de lichens et a pu voir beaucoup de thèques.* J'ai observé maintes fois des sporidies, qui plus tard devaient être marquées de vingt cloisons, n'en présenter d'abord qu'une seule et être ainsi dans leur enfance seulement biloculées." With respect to the shapes of the sporidia, it is the opinion of Dr. Montagne (and no one's opinion can be entitled to greater consideration) that the sporidia of the same species, however unlike themselves in their young or abnormal state, do nevertheless vary but little in the same species, when well-developed. We have as yet made too few observations on this obscure subject to have much confidence in our own judgement, but both from these few and from the figures and remarks of others, it appears to us to be necessary that very great care should be taken not to distinguish lichens at once by a difference in the sporidia, when that difference may arise solely from a difference of age in the plant or from other and unknown causes. Mr. Leighton's figures themselves show how much the sporidia vary in the same species (see *V. Hookeri*, plate xxvii.).

Although Mr. Leighton's bias is different from our own as to the adjustment of species, we are far from saying that his views may not often be correct, where we are disposed to entertain suspicions. His careful analysis, moreover, and excellent descriptions will make any errors into which he may chance to have fallen of comparatively easy correction; and the very obscurity of the subject is such that it is impossible to avoid mistakes. Some misapprehensions of his predecessors have been rectified by Mr. Leighton; many species have received additional elucidation; and several undoubtedly new ones have been added. We shall look with interest to the approaching portions of the work, and may perhaps afterwards discuss some subjects connected with it of which we have now said nothing.

Nereis Boreali-Americana; or Contributions towards a History of the Marine Algæ of the Atlantic and Pacific Coasts of North America. By William Henry Harvey, M.D., M.R.I.A. &c. Part I. Melanospermeæ. Washington. Published for the Smithsonian Institution. London: John Van Voorst.

The author of this very beautiful book is so well known to the lovers of Marine Botany, that it is almost superfluous to do more than announce its appearance. At the same time, the circumstance of this being the first systematic description of North American Algæ, confers too much interest upon the undertaking to justify its being hastily passed over. We must take leave to congratulate our transatlantic friends upon having secured the services of Dr. Harvey, in whom are

combined more of the requisites for such a work than could probably be found in any other living naturalist; for in addition to a knowledge of his subject matured by long study and a familar acquaintance with the algological forms of both hemispheres, he is his own artist, even to the execution of his drawings on the stone. Besides this rare advantage, Dr. Harvey has cultivated a popular style without any compromise of scientific accuracy. Last, but not in our estimation least, a healthy moral tone pervades all his writings. It is surely fitting that descriptions of the wonders of external nature, interesting to all, but pre-eminently attractive to the young, should be made to serve a higher purpose than perfecting our knowledge of scientific affinity, or gratifying a mere intellectual curiosity. "The study of organic nature," remarks Dr. Harvey, in some valuable observations on the noble teaching to be derived from it, "ought to be one of the purest sources of intellectual pleasure. It places before us structures the most exquisite in form and delicate in material; the perfect works of Him who is Himself the sum of all perfections:—and if our minds are properly balanced, we shall not rest satisfied with a mere knowledge and admiration of these wonderful and manifold works; but, reading in them the evidence of *their* relation to their Maker, we shall be led on to investigate *our own*" (p. 41).

The work is introduced by an Essay on the general structure, uses, and mode of preserving Marine Algæ; as well as on the geographical distribution of the American species. The author is of opinion that additional researches will indicate four regions of distribution on the eastern and southern shores of the North American States, viz.:—

1. *Coast north of Cape Cod, extending probably to Greenland.* Characterized by the great *Laminariæ.*

2. *Long Island Sound, including New York Harbour and the Sands of New Jersey.*

3. *Cape Hatteras to Cape Florida.* It is remarkable that no Fucoid alga has as yet been observed in this region.

4. *Florida Keys, and Shores of the Mexican Gulf.* This region has been very imperfectly explored, but seems strongly marked; as out of 130 species collected by Dr. Harvey at Key West in February 1850, scarcely one-eighth are found on the east coast.

Notwithstanding the collections which have been already made, the results of which will appear in the present work, a multitude of species doubtless remain to be discovered by American botanists both on the east and west coasts (especially the latter), and a greater stimulus to investigation can hardly be afforded than the appearance of this 'Nereis Boreali-Americana.' Nearly one hundred species are described in the part under review, completing the Melanospermeæ, with exquisite coloured illustrations of the most interesting, especially some curious new *Ectocarpeæ.* We would take this opportunity of directing the special attention of American botanists to the *Laminariæ,* which, as Dr. Harvey justly remarks, can only be properly studied on the spot and by extended observations. *Laminaria longipes, cornea,* and other forms described by Bory de St. Vincent, from Newfoundland, are,

parison with the numerous remains which have been sent home from New Zealand.

Upon a cursory view of this bird it might be mistaken for a gigantic kind of *Porphyrio,* but on an examination of its structure it will be found to be generically distinct. It is allied to *Porphyrio* in the form of its bill and in its general colouring, and to *Tribonyx* in the structure of its feet, while in the feebleness of its wings and the structure of its tail it differs from both.

From personal observation of the habits of *Tribonyx* and *Porphyrio,* I may venture to affirm that the habits and œconomy of the present bird more closely resemble those of the former than those of the latter; that it is doubtless of a recluse and extremely shy disposition; that being deprived, by the feeble structure of its wing, of the power of flight, it is compelled to depend upon its swiftness of foot for the means of evading its natural enemies; and that, as is the case with *Tribonyx;* a person may be in its vicinity for weeks without ever catching a glimpse of it.

From the thickness of its plumage and the great length of its back-feathers, we may infer that it affects low and humid situations, marshes, the banks of rivers, and the coverts of dripping ferns, so abundant in its native country: like *Porphyrio,* it doubtless enjoys the power of swimming, but would seem, from the structure of its legs, to be more terrestrial in its habits than the members of that genus.

I have carefully compared the bill of this example with that figured by Professor Owen under the name of *Notornis Mantelli,* and have little doubt that they are referable to one and the same species; and as we are now in possession of materials whence to obtain complete generic characters, I hasten to give the following details, in addition to those supplied by Professor Owen.

Bill somewhat shorter than the head; greatly compressed on the sides, both mandibles being much deeper than broad; tomia sharp, curving downwards, inclining inwards and slightly serrated; culmen elevated, much arched and rising on the forehead to a line with the posterior angle of the eye; *nostrils* round, and placed in a depression near the base of the bill; wings very short, rounded, and slightly concave; primaries soft and yielding; the first short; third, fourth, fifth, sixth and seventh equal and the longest; tail-feathers soft, yielding, and loose in texture; tarsi powerful, longer than the toes, almost cylindrical; very broad anteriorly; defended in front and on either side posteriorly by broad and distinct scutellæ; the spaces between the scutellæ reticulated; anterior toes large and strong, armed with powerful hooked nails, and strongly scutellated on their upper surface; hind-toe short, strong, placed somewhat high on the tarsus, and armed with a blunt hooked nail.

Head, neck, breast, upper part of the abdomen and flanks purplish blue; back, rump, upper tail-coverts, lesser wing-coverts and tertiaries dark olive-green, tipped with verditer-green; at the nape of the neck a band of rich blue separating the purplish blue of the neck from the green of the body; wings rich deep blue, the greater coverts tipped

with verditer-green, forming crescentic bands when the wing is expanded; tail dark green; lower part of the abdomen, vent and thighs dull bluish black; under tail-coverts white; bill and feet red.

Total length of the body, 26 inches; bill, from the gape to the tip, $2\frac{1}{8}$; from the tip to the posterior edge of the plate on the forehead, 3; wing, $8\frac{1}{2}$; tail, $3\frac{1}{2}$; tarsi, $3\frac{1}{2}$; middle toe, 3; nail, $\frac{7}{8}$; hind-toe, $\frac{7}{8}$; nail, $\frac{3}{4}$.

I cannot conclude these remarks without bearing testimony to the very great importance of the results which have attended the researches of Mr. Walter Mantell in the various departments of science to which he has turned the attention of his cultivated, intelligent and inquiring mind, nor without expressing a hope that he may yet be enabled to obtain some particulars as to the history of this and the other remarkable birds of the country in which he is resident.

BOTANICAL SOCIETY OF EDINBURGH.

January 8, 1852.—Dr. Seller, President, in the Chair.

Dr. Balfour read an extract from a letter which he had received from Dr. R. C. Alexander, in which he remarks:—"Should any collector be undecided where to fix himself, I would recommend the West Indies. Although longer known to us than any other tropical country, it is still very imperfectly explored, and every island yields different results. The Blue Mountain peak is almost *un*explored. I ascended it once only, not being aware how many of the species were new till my return; the usual case, for even if you have the books, you have no time to use them. The Cuban species, as far as can be deduced from De Sagia's Flora, seem to be very different, and almost equally those of St. Domingo, of which there is a large collection at Philadelphia, made by a French botanist, Pouteau I think, before the Revolution."

Mr. M'Nab mentioned that on the 7th instant the following plants were in flower in the open air, in the Royal Botanic Garden:—*Tritonia media, Helleborus niger, Phlox verna, Primula veris, Hepatica triloba, Doronicum caucasicum, Pyrus japonica*, and *Tussilago fragrans*; and Dr. Greville stated that he had received sweet violets from the neighbourhood of Darlington a few days since.

The following papers were read:—

1. "Descriptions of *Rubi*," by Charles C. Babington, M.A. (See p. 123.)

2. "On the Growth of various kinds of Mould in Syrup," by Professor Balfour. Much interest has been recently excited by statements relative to the Vinegar Plant, as it has been called. This plant, which has a tough-gelatinous consistence, when put into a mixture of treacle, sugar and water, gives rise to a sort of fermentation by which vinegar is produced. After six or eight weeks the original plant can be divided into two layers, each of which acts as an independent plant, and when placed in syrup continues to produce vinegar, and to divide at certain periods of growth. The vinegar

thus produced is always more or less of a syrupy nature, and when evaporated to dryness, a large quantity of saccharine matter is left. Various conjectures have been hazarded as to the origin of the so-called vinegar-plant, some stating that it came from South America or other distant regions, and others that it is a spontaneous production. Lindley states that it is a peculiar form of *Penicillium glaucum*, or common blue mould. There seems to be no doubt that it is an anomalous state of mould or of some fungus, and the peculiarity of form and consistence appears to be owing to the material in which it grows. In place of producing the usual cellular sporiferous stalks, the mycelium increases to an extraordinary extent; its cellular threads interlacing together in a remarkable manner and producing one expanded cellular mass, with occasionally rounded bodies like spores in its substance. The cellular filaments may be seen under the microscope. The tendency to divide in a merismatic manner is common in many of the lower classes of plants, and this seems to be what occurs at a certain period of growth, when the plant divides into two horizontal plates. If the plant is allowed to continue growing, it forms numerous plates one above the other. The anomalous forms of fungi in certain circumstances have lately excited much interest, and Mr. Berkeley has called attention to some of the remarkable transformations which they undergo. These are such, that many forms considered as separate genera are now looked upon as mere varieties of one species.

That mould of various kinds when placed in syrup shows the same tendency to form a flat gelatinous or somewhat leathery expansion is shown by the following experiments.

Some mould that had grown on an apple was put into syrup on the 5th of March, 1851, and in the course of two months, there was a cellular flat expanded mass formed, while the syrup was converted into vinegar. Some of the original mould was seen on the surface in its usual form.

Some mould from a pear was treated in a similar way with the same result; also various moulds growing on bread, tea, and other vegetable substances; the effect in most cases being to cause a fermentation, which resulted in the production of vinegar.

In another experiment on the 8th of November, 1850, a quantity of raw sugar, treacle, and water were put into a jar without any plant being introduced, and they were left untouched till March 5, 1851. When examined, a growth like that of the vinegar plant was visible and vinegar was formed. The plant was removed and put into fresh syrup, and again the production of vinegar took place.

It would appear from experiment, that when purified, white sugar alone is used to form syrup, the plant when placed in it does not produce vinegar so readily, the length of time required for the changes varying from four to six months. There may possibly be something in the raw sugar and treacle which tends to promote the acetous change.

Dr. Greville remarked that he had no doubt that the vinegar-plant was an abnormal state of some fungus. It was well known that

many fungi in peculiar circumstances presented most remarkable forms. He instanced the so-called genus *Myconema* of Fries, as well as the genus *Ozonium*. Even some of the Agarics present anomalous appearances, such as the absence of the pileus, &c., in certain instances. The remarkable appearances of dry-rot in different circumstances are well known. Although syrup when left to itself will undergo the acetous change, still Dr. Greville was satisfied that the presence of this plant promoted and expedited the change.

Professor Simpson remarked, that the changes in Fungi may resemble the alternation of generations so evident in the animal kingdom, as noticed by Steenstrup and others. In the Medusæ there are remarkable changes of form, and there is also the separation of buds, resembling the splitting of the vinegar-plant.

Mr. Embleton remarked, that in the neighbourhood of Embleton in Northumberland, every cottager used the plant for the purpose of making vinegar.

3. "The Results of some Experiments relative to the Growth of Alpine Plants, after having been kept artificially covered with snow in an ice-house for many months," by Prof. Simpson. Seeds and plants kept in this way during winter, and then brought into the warm air of summer, germinate and grow with great rapidity. Mr. John Stewart had also made experiments with animals, and he found that the chrysalis so treated produced a moth in eleven days, after being brought into the atmosphere; while other chrysales of the same moth did not do so until three or four months afterwards. In the Arctic regions the rapid growth of plants during the short summer was well known. Professor Simpson alluded to the importance of similar experiments being made on the different kinds of grain. He referred to the rapidity of the harvest in Canada and other countries, where the cold lasted for many months, and he was disposed to think that if grain was kept in ice-houses during winter, and sown in spring, there might be an acceleration of the harvest. He considered the subject deserving of the attention of agriculturists, for the saving of a few weeks in the ripening of the crops would be of vast consequence in Britain. Moreover there might be less necessity for exposing the crops to the variable springs of this country, for the sowing might be retarded.

Professor Simpson is still carrying on his experiments; he hoped to communicate farther results at a future meeting.

4. "Notice of Plants found near London," by Mr. G. Lawson. Mr. Lawson spent a day in botanizing the neighbourhood of Wandsworth, Wimbledon, Putney, and Battersea, in Surrey, in September 1851, and found a few plants, which, although probably introduced, were worthy of notice, as not having been previously recorded in those localities. He exhibited specimens of the following:—

Anacharis Alsinastrum, Bab. Found in ditches at Wandsworth Common, where it was intermixed with *Potamogeton densus*.

Trifolium ochroleucum, L., Wandsworth Common. This species is admitted by Mr. Watson as a native in the Thames province. (Cybele, i. 263.)

Trifolium resupinatum, L., Wandsworth Common. Of course introduced.

Scorpiurus subvillosus, L. In a cultivated field near to the Wandsworth Railway Station: a southern European species, and certainly not a native.

Melilotus parviflora, Desf., Wandsworth Common; also in a cultivated field to the eastward of the Wandsworth Railway Station. This is very distinct from any other species found in Britain. The racemes are dense, in fruit elongated and lax; pods subglobose, very obtuse, distinctly reticulate-rugose, glabrous, containing each one large globular seed; leaflets somewhat retuse, serrate, obovate- or oblong-cuneate. Flowers small, not twice the length of the calyx, deep yellow.

This species appears to be widely diffused over the globe, although in some regions probably as a naturalized plant only; its extensive geographical range is shown by the following notices of specimens which were exhibited from the Herbarium in the University of Edinburgh. In Rugel's collection of Florida plants, there are specimens of it. No. 171, labelled: "Locis arenosis soli expositis et ad littora maris, prope St. Augustine, Florida or., Apr.—Mai. 1848." In the Indian collection there are several specimens showing its prevalence in India, where it appears in the dry season; one of them from Dr. Roxburgh is labelled in his own handwriting, "Trifol. M. indica var.?" Another is from Dr. Jameson, from Saharunpore; and in the admirable collection of the Countess of Dalhousie there is a beautiful and characteristic specimen. Dr. Pappe notices this as one of the foreign medicinal plants in which the inhabitants of South Africa have confidence, so that the species would appear to be found there in a *naturalized* condition. It has no claim to be considered *native* in England, as even in the south of France it is only found in lucerne fields.

5. "Notice of the abnormal structure of a Turnip," by Mr. James B. Davies. The author of this paper remarked that all roots are subject to variation, as well from non-development as from increased growth. He exhibited a monstrous turnip having the appearance of two bulbs joined in the form of an hour-glass; this he conceived to have been caused by some injury to the root, arresting the expansion of the superior or first-formed bulb. He likewise exhibited another specimen presenting two bulbs united at the neck, the union extending to a third of their circumference. Mr. Davies did not believe that such monstrosities as this resulted from the chemical condition of the soil, or from the opposition of any external body in the soil; but that one, instead of two, tap-roots were originally produced of equal dimensions. This conclusion he had arrived at from an examination of their internal structure, having traced a mass of the small cells resembling those found towards the exterior of the bulb, rising to a considerable height through the root, thus forming an apparent wall between the two bulbs. He had likewise found, in tracing the course of the fibres, that two great masses arose from the crown, and proceeded in separate courses one to each bulb. As a remedy for

the disease, Mr. Davies recommended the raising of seed from transplanted bulbs. He illustrated his remarks by drawings, showing the structure of the turnips alluded to and the structure usually seen in the turnip bulb.

Dr. Balfour read a letter from Dr. Ernest Meyer of Konigsburg, intimating the transmission of a collection of interesting plants from M. Patze, who has paid particular attention to the species of willow. "As regards the willows," Dr. Meyer remarks, "which constitute M. Patze's delight, I can assure you that each specimen in leaf is taken from the same plant as those which are in flower, whether male or female. As to the hybrid forms of the genus *Salix*, which have caused such confusion in our systems, there is not one of them which has not been observed by M. Patze for several years, and found almost always sterile and in small quantity among the two common species, which he suspects to be the parents."

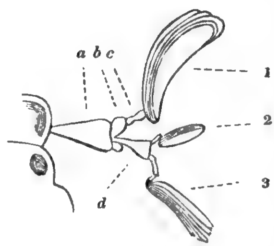
MISCELLANEOUS.

Note on a Monstrosity observed in the Cockchafer (Melolontha vulgaris). By M. Lereboullet, M.D.

Monstrosities, without being exactly very rare in articulated animals, and in particular in insects, are, nevertheless, not so common as to render it useless to describe them when they occur. This consideration has determined me to make known a rather curious anomaly which I observed last year in a female cockchafer, which consists in the existence of three antennæ on the right side. I have annexed to this note a representation of the specimen, which is preserved in the museum at Strasbourg.

The antenna of the left side is normal; the club is 4 millimetres ($\frac{1}{6}$ inch) in length, and is composed of seven leaves.

The right antenna has its first joint (*a*) longer and broader than the same joint on the left side. This joint is enlarged at the extremity, where it presents two pits, into which are articulated two other portions of the antenna, one simple, the other double; that is to say, there are three antennæ, each terminated by a foliated club.



The first of these two portions (No. 1) is composed of a short, globular basal joint (*b*) attached to the articulation; of an elongated second joint (*c*), resembling in form the penultimate joint of the normal antenna; and of a foliated club, consisting of seven lamellæ which measure 3 millimetres ($\frac{1}{8}$ inch) in length, and consequently are a little shorter than those of the normal antennæ. The whole of this portion is inclined downwards; it appears to me to represent the true antenna.

The second portion, which is supported by the basal joint (a), consists of a first joint (d), which itself acts as a basal joint to the two other antennæ, and represents consequently the joint a of the whole antenna. This first joint is inserted above the small globular joint b; it is enlarged at the extremity, and its form is the same as that of the general basal joint; like it, also, it presents two articulatory surfaces; one, directed downwards, bears the second antenna (2); the other, turned upwards, serves for the articulation of the third antenna (3).

The second antenna (2), or first supplementary antenna, is composed of two pieces, namely an elongated joint, resembling in form the joint c of the first antenna, and the club, which is composed of seven lamellæ, and is only $1\frac{1}{2}$ millimetre in length.

The third antenna (3) is composed, like the preceding, of an elongated joint and a club; the latter measures $2\frac{1}{2}$ millimetres, and consists like the preceding of seven lamellæ.

Thus, the right antenna is composed of portions which are repetitions of one another; of a first normal antenna, of a second antenna, grafted, as it were, upon the first, and of a third grafted upon the second; only, in the latter the basal joint is wanting. We might also say, that the primitive antenna bears a bifurcate supernumerary antenna.

[After mentioning several cases of monstrosities by excess in Coleopterous insects, described by various authors, and referring to the theory proposed by M. Bassi (Ann. Soc. Ent. Fr. iii. p. 373) to account for these phænomena, M. Lereboullet proceeds to give his own views on this subject as follows:—]

Without pretending to wish to establish a theory of the mode of production of these anomalies in the Articulata, I will remark, that, in these animals, the appearance of the limbs takes place by a sort of *shooting* or *budding* subject to determinate laws for each species, and which is manifested, at a given period of development, on determinate points of the surface of the body. It is this great law of centrifugal or peripheric development which determines the number of joints of which the antennæ or the feet are composed, the form of each of the joints, and the general form of the member. Now, the development of these parts can only take place at the expense of the nutritive juice; it is the blood which contains the primordial elements of the organs, or, to be more exact, furnishes the materials of which they are composed. If we suppose now that from some cause there is a superabundance of blood in one part, there might result from it a hypertrophy of the organs; but as this has not yet completed its evolution, the same part repeats itself several times and in the same form, on account of the primary law which presides at the development of each piece,—a true *nisus formativus* which appears to *run* each organ into a mould, which we may call *specific*, as it is always the same for the same species and only belongs to *it*. Thus, for example, in the case above described, the first joint of the abnormal antenna is larger than the same piece in the normal antenna. There has therefore been excess of nutrition in this part, and we may suppose that in consequence of this excess of nutrition it has formed several antennæ similar to one another.

I believe, therefore, that in monstrosities by excess there is not a

division of the organs, but rather a production of new organs superadded to the primary organ, or what comes to the same thing, a repetition of the same organ on a part of the body where it should exist alone*.—*Revue et Magasin de Zoologie,* Sept. 1851, p. 453.

Description of a new species of Macgillivrayia. By A. Adams, F.L.S.

To the Editors of the Annals of Natural History.

R.N. Hospital, Haslar, Gosport, Feb. 23, 1852.

Gentlemen,—I send you the description of a new species of *Macgillivrayia,* a genus of mollusca just established by Prof. Forbes, and as it is a member of a very novel form, I shall feel obliged by your inserting it in your next number.

I remain, Gentlemen, yours very truly,
Arthur Adams, F.L.S.

Macgillivrayia spinigera, A. Adams.

Testa turbinata, tenui, cornea, glabrata, semipellucida, imperforata; spira brevi, anfractibus subplanulatis; apertura oblonga, integra, antice subangulata; labio recto, antice producto, in spina acuminata desinente.

Hab. Mindoro Sea.

The great peculiarity of this species is the circumstance of the columellar lip ending anteriorly in a produced spine; the surface moreover is glossy, the shell more transparent, the whorls of the spire less rounded, and the spire itself less prominent than in *M. pelagica* of Forbes. The operculum is that of the genus.

On the Anatomy and Physiology of Salpa *and* Pyrosoma. By Thomas H. Huxley, F.R.S.

The object of the author in the present paper is to inquire into the true nature of the singular phænomena of reproduction in the *Salpæ,* whose existence was first demonstrated by Chamisso twenty years ago, and which have formed the basis of the theory of "alternate generations."

The author refers to M. Krohn as the only writer who has previously entered thoroughly into this subject; but while he bears testimony to the extreme accuracy of M. Krohn's statements, he submits that, as the latter are published in a very condensed form only, and without figures, they cannot affect any value that may attach to his own independent researches.

The forms of *Salpa* examined were the *S. democratica* and *S. mucronata.*

The author first describes their outward form, and shows that they are so different in appearance and in some points of organization, as to fully warrant the assumption (if they belonged to any other family) that they are different species. He then proceeds to describe the various organs in detail; first, however, discussing the

* In a subsequent number of the 'Revue et Mag. de Zoologie,' M. Guérin Méneville states that a similar deformity in the right antenna of a male cockchafer had been described and figured by M. Wesmael in the 'Bulletins de l'Acad. des Sciences de Bruxelles' for 1849.

proper nomenclature of the sides and ends of these animals, a subject on which much confusion has prevailed. Particular attention is called to the existence of an organ hitherto undescribed—a cylindrical, elongated body, like an internal shell,—here termed the "*endostyle*," which lies in the dorsal sinus, and has hitherto been confounded with the "dorsal folds" of Savigny. A peculiar system of delicate transparent vessels, taking its origin in the stomach and ramified over the intestine, is described and its nature inquired into.

The organs of reproduction are next inquired into. The young in the *Salpa democratica* constitute a "Salpa-chain," and are shown to arise by *gemmation* from a tubular diverticulum of the vascular system of the parent. In the course of their development they take the form of the *S. mucronata*.

The young in the *Salpa mucronata* again is shown to be solitary, and attached to one point of the respiratory chamber of the parent by an organ which exactly represents in its structure a rudimentary mammiferous placenta, except that in the *Salpæ* the "villus" is formed by the maternal system, the "placental cell" by the fœtal system. But the fœtus here is not produced by *gemmation*, as in the preceding case, but by a true process of *sexual generation*.

Every *Salpa mucronata* contains at one period of its existence a solitary ovum, and a testis, which is a ramified gland surrounding the intestine, and hitherto confounded with the liver. The solitary ovum becomes fertilized, pushed out into the respiratory cavity of the parent, and remains connected with the latter until it has assumed the form of the *Salpa democratica*, when it becomes detached.

Chamisso's formula therefore, "that the parent *Salpa* produces an offspring different from itself, which again produces an offspring different from *itself*, but similar to its parent," is perfectly correct, only the word "produce" has two meanings—in the one case signifying *a process of gemmation*, in the other of *true sexual generation*.

The author next proceeds to describe the anatomy of *Pyrosoma*, and to point out its general harmony with that of *Salpa*. He shows the existence of an endostyle—a system of ramified intestinal tubules—and of other organs precisely resembling those described in the latter genus. The "hepatic organ" of Savigny is the testis, while the female generative organ consists of solitary pedicillate ova. The arrangement of their parts is essentially the same as in *Salpa*, only that the fœtus does not appear to be developed in placental connexion with the parent.

The *Pyrosomata* increase by gemmation also, but the gemmæ are solitary and do not form chains, becoming developed like those of the ordinary compound Ascidians between the pre-existing forms.

In the next section, the zoological relations of the *Salpæ* and *Pyrosomata*, with the other Ascidians, are inquired into. The author endeavours to show that there is no essential difference of organization between the ordinary Ascidians and the *Salpæ*; that the two forms grade insensibly one into the other; and that there is, therefore, no ground for breaking up the great ascidian family into the two subdivisions of Monochitonida and Dichitonida.

With regard to the theory of the "alternation of generations,"

the author submits that it is by no means a proper expression for the phænomena presented by the *Salpæ*. According to the author's view, the two forms of *Salpa* are not two generations of distinct individuals, but are, properly speaking, organs, and only when taken together, equivalent to an individual, in the sense in which that term is used among the higher animals.

For these pseudo-individuals, in this and all analogous cases, the author proposes the name of "*zoöids*," simply for the purpose of avoiding the apparent paradox of calling these highly-organized independent forms "*organs*," though such, in the author's opinion, they really are.—*Phil. Trans.* Part 2. 1851.

LARUS GLAUCUS.

To the Editors of the Annals of Natural History.

Weymouth, February 16, 1852.

GENTLEMEN,—On the 26th of January in this year, a specimen of the Glaucous Gull (*Larus glaucus*) was caught on the Chesil Beach, between the village of Fleet and Abbotsbury. This was a young bird, but very large; from the carpal joint to the end of the longest quill-feather measures 19 inches. The upper tail-coverts are spotted with *very faint* pale brown, the tail-feathers barred with very narrow streaks of very faint brown scarcely perceptible. Bill very pale brown. Legs and feet the same. In all other respects it has the plumage of the adult bird.

This bird was taken in a noose set for gulls, which are caught solely for their feathers, and many are captured annually for this purpose.

A heap of sea-weed is put together, and two sticks driven in opposite each other on the weed and at about a foot apart; to these sticks is firmly attached a wire noose (like those used by poachers) which is supported by the sticks. Under this noose a fish is placed on the heap of weed; this attracts the gulls, and in making a swoop to seize the fish they dash into the noose and are thus secured.

I am, Gentlemen, yours obediently,

WILLIAM THOMPSON.

Algæ taken in Cork Harbour or along the coast during the Summers of 1850 *and* 1851. By J. CARROLL.

Sporochnus pedunculatus, Ag. Cork Harbour, 1850: washed up.

Myrionema punctiforme, Harv. Tide-pools, 1850: on *Ceramium Deslongchampsii*.

Ectocarpus Hincksiæ, Harv.

Rytiphlæa thuyoides, Harv. Rocks at either side of Cork Harbour, but rare.

Polysiphonia obscura, J. Ag. Sand-covered rocks below Queenstown, Sept. 1851. Our Irish specimens are much finer than those from the South of England.

Polysiphonia simulans, Harv. Mud-covered rocks, Rat Island, at low-water mark, June 1850.

Stenogramme interrupta, Mont. Dredged in Cork Harbour, Sept. 1851, growing on small stones in 5 to 6 fathoms water. Plants *in both states of fructification* were procured.

Gigartina acicularis, Lam. Rocks, Camden Fort, June 1851: very sparingly.

Ginnania furcellata, Mont. On a shell in 5 to 6 fathoms.

Ceramium fastigiatum, Harv., *var.* Below Queenstown, Sept. 1850: cast up in considerable quantity.

C. flabelligerum, J. Ag. Cork Harbour: very rare. Kinsale: more plentiful.

C. acanthonotum, Carm. Kinsale: rare: Sept. 1851.

Callithamnion virgatulum, Harv. On *Ceramium diaphanum.*

Cladophora Macallana, Harv. Taken by the dredge—probably common on our coast.

C. Hutchinsiæ, Harv. With the preceding.

C. gracilis, Griff.

C. refracta, Kütz.

Anatomical Observations on the Dasyurus (Sarcophilus) ursinus. By M. W. Vrolik.

The zoological garden of Amsterdam has recently furnished an opportunity of clearing up several points in comparative anatomy, by placing under the scalpel of Professor Vrolik, the body of the *Dasyurus ursinus*, a singular animal which has lived for a considerable time in that place.

The *Dasyurus* (or *Sarcophilus*) *ursinus* is an inhabitant of Van Diemen's Land; it belongs to the group of carnivorous marsupials, and bears a resemblance to the Bears both in its general structure and its plantigrade movement. This animal disappeared rapidly before the increasing population, and has taken refuge in the most remote portions of the colony, where it goes by the name of "devil."

The dental system of the *Dasyurus* presenting a great analogy with that of the true Carnivora, it became an interesting point to ascertain how far the rest of its organization agreed with this external character, and it is to this point that M. Vrolik has directed his attention. The results of his labours are as follows:—

The head of the *Dasyurus ursinus* resembles that of the Hyæna in form, although it possesses several characters peculiar to the marsupials—such as the great opening of the bones of the palate which produces a resemblance to the same part in birds—the situation of the carotidian canals, which traverse the body of the sphenoid bone —the existence of four true molars in place of three—the internal elongation of the posterior angle of the lower jaw, &c. Besides these characters of the head, there are several other peculiarities which coincide to place the *Dasyurus* among the true marsupials—such as the structure of the wrist, the union of the two bones of the leg, and more especially the existence of the marsupial bones.

The temporal muscles and masseters, the muscles of the neck and of the extremities, are the same as those of the true Carnivora; in fact, it is only in the abdominal muscles that we observe any differences, and these result from the presence of the marsupial bones and of the abdominal pouch. The brain is like that of other marsupials, bearing a considerable resemblance in structure to that of birds. The respiratory and circulatory organs scarcely offer any peculiarities, ex-

cept the slight development of the larynx*, and the equality of the two auricles of the heart. The digestive organs rather resemble those of the Carnivora than those of the herbivorous marsupials.

The result of these researches therefore is, that although the *Dasyurus ursinus* resembles the plantigrade Carnivora in its appearance and mode of life, its organization and internal structure place it incontestably amongst the marsupials.—*Bibl. Univ. de Genève*, Dec. 1851, p. 346.

On the Nervous System of Insects. By M. Dujardin.

Persuaded that insects were not moved in their actions by instinct only, but also by a peculiar intelligence, M. Dujardin has examined into the organization of their nervous system, to see if it would confirm this idea which he had deduced from the observation of facts, and in particular whether the supra-œsophageal ganglion, to which the name of 'brain' had been given, although only on account of analogy of position, did not present another resemblance of much greater importance, that of intimate structure and organization,—in other words, whether insects had, or had not, a brain. The results of his observations are,—

1. That in some articulated animals there exists a true brain, of which the structure and volume correspond with the development of the intellectual faculties: thus, if we compare the volume of the brain of the ant with that of the cockchafer, we shall find that they are as 1–7, whilst the volumes of their bodies are as 1–100.

2. That the brain, or supra-œsophageal ganglion, contains symmetrical bodies of a well-determined form, to which he has given the name of *corpora pedunculata* (corps pédonculés); these organs are more or less completely surrounded by a pulpy cortical substance, which is relatively less considerable in the most intelligent insects, and predominates in those in which intelligence is masked by instinct, whilst it occurs alone in those insects which are only endowed with the latter faculty.

3. The same pulpy substance appears also to occur by itself in those ganglia of the thorax and abdomen which assist in purely instinctive actions.—*Ib.* Sept. 1851, p. 74.

OBITUARY.—WILLIAM THOMPSON, F.L.S., PRESIDENT OF THE NATURAL HISTORY SOCIETY OF BELFAST.

It is with much regret we have to record the death of Mr. William Thompson, of Belfast, which took place very suddenly in London on Tuesday morning Feb. the 17th. Mr. Thompson had been visiting our metropolis chiefly with a view to making arrangements for the approaching meeting of the British Association in Belfast, of which he had been appointed by the Council a Vice-President. Mr. Thompson was well known as a writer on various branches of natural history. Science is indebted to him for the ardour with which he investigated

* The slight development of the larynx is a character peculiar to the marsupials, which accounts for these animals being generally mute. Like them, the *Dasyurus* at Amsterdam never emitted any sound except a low grunting, and even this very rarely.

the zoology of his native country; and the large number of his papers in the 'Annals and Magazine of Natural History,' to which he has been a contributor from the beginning, attest his great diligence in this respect. He was an early friend of the British Association for the Advancement of Science, and at the meeting held at Glasgow delivered in a Report on the Fauna of Ireland. He constantly attended its meetings; and subsequently to his Report in 1840, he contributed many papers on the Natural History of Ireland. It was owing to his efforts that the Natural History Section was so remarkably successful when the Association met at Cork. His investigations on the Zoology of Ireland were subservient to a great work which he had planned on the Natural History of that island, and which, had his life been spared, there is no reason to doubt he would have completed. 'The Birds of Ireland' was the first part of this work. Our readers will be glad to learn that he had made arrangements for the publication of his MSS., and nominated two of his most intimate personal friends in Belfast to take charge of the work, in the event of his death before the publication of the remaining volumes should have been completed; there will therefore be no delay beyond what is absolutely unavoidable. His loss will be deeply felt at Belfast, in the institutions of which city he took deep and active interest. He died in the forty-seventh year of his age.

METEOROLOGICAL OBSERVATIONS FOR JAN. 1852.

Chiswick.—January 1. Hazy: overcast. 2. Overcast: fine: slight rain. 3. Foggy: very fine: cloudy: boisterous at night. 4. Clear and very fine: frosty. 5. Frosty: clear and fine. 6. Clear: very fine. 7. Rain. 8. Cloudy: boisterous. 9. Quite clear: overcast. 10. Frosty: clear and fine: rain. 11. Rain: overcast. 12. Constant rain. 13. Foggy, with rain. 14. Foggy: rain. 15. Cloudy. 16. Densely overcast: fine. 17. Very fine. 18. Hoar frost: very fine. 19. Frosty: very fine. 20. Densely clouded. 21. Fine: rain at night. 22, 23. Clear and very fine. 24. Rain. 25, 26. Very fine. 27. Fine: rain. 28. Foggy: fine: clear: frosty at night. 29. Foggy and frosty: very fine. 30. Rain: heavy clouds: clear. 31. Densely overcast: rain.

Mean temperature of the month	39°·66
Mean temperature of Jan. 1851	40 ·07
Mean temperature of Jan. for the last twenty-six years	36 ·79
Average amount of rain in Jan.	1·68 inch.

Boston.—Jan. 1, 2. Cloudy. 3. Fine. 4. Fine: hail-storm early A.M. 5, 6. Fine. 7. Cloudy: rain P.M. 8. Cloudy. 9. Cloudy: rain A.M. 10. Fine. 11. Fine: rain early A.M. 12. Cloudy: rain early A.M. 13. Cloudy: rain P.M. 14. Cloudy. 15. Cloudy: rain A.M. and P.M. 16—19. Fine. 20. Cloudy: rain P.M. 21. Fine: rain P.M. 22. Fine: rain early A.M. 23. Fine. 24. Cloudy: rain A.M. and P.M. 25, 26. Fine. 27. Cloudy: rain P.M. 28. Fine. 29. Foggy. 30. Rainy: rain A.M. and P.M. 31. Cloudy: rain A.M. and P.M.

Sandwick Manse, Orkney.—Jan. 1. Rain. 2. Showers: sleet-showers. 3. Cloudy: sleet-showers. 4. Snow-showers. 5. Rain: cloudy. 6. Rain: showers. 7. Showers: snow-showers. 8. Frost. cloudy. 9. Showers: snow-showers. 10. Snow-showers cloudy. 11. Snow-showers: clear: aurora. 12. Cloudy: showers. 13. Showers: clear: aurora. 14, 15. Bright: cloudy. 16. Showers: cloudy. 17. Showers. 18. Showers: damp. 19. Bright: clear: aurora. 20, 21. Cloudy: rain. 22. Cloudy: showers: thunder and lightning. 23, 24. Showers: clear: aurora. 25. Sleet-showers: aurora. 26. Drops: cloudy. 27. Hazy: cloudy. 28. Fine: clear: large halo. 29. Drizzle: showers. 30. Showers: sleet-showers. 31. Showers: thunder and lightning: showers.

Meteorological Observations made by Mr. Thompson *at the Garden of the Horticultural Society at* Chiswick, *near London;*
by Mr. Veall, *at* Boston; *and by the* Rev. C. Clouston, *at Sandwick Manse,* Orkney.

Days of Month.	Barometer.					Thermometer.					Wind.			Rain.		
	Chiswick.		Boston. 8½ a.m.	Orkney, Sandwick.		Chiswick.		Boston. 8¾ a.m.	Orkney, Sandwick.		Chiswick. 1 p.m.	Boston.	Orkney, Sandwick.	Chiswick.	Boston.	Orkney, Sandwick.
1852. Jan.	Max.	Min.		9¼ a.m.	8½ p.m.	Max.	Min.		9¼ a.m.	8½ p.m.						
1.	29·956	29·784	29·61	29·66	29.30	35	21	37	44	43	n.	sw.	w.	....	....	·15
2.	29·694	29·637	29·36	29·03	29·20	41	26	36	42½	40	sw.	wsw.	w.	·02	....	·24
3.	29·746	29·512	29·43	29·24	28·84	49	38	30	35½	37½	sw.	s.	w.	·10	....	·15
4.	30·122	29·539	29·30	29·28	29·72	44	20	42·5	32½	35	nw.	wnw.	w.	....	·18	·36
5.	30·198	30·064	29·86	29·53	29·26	45	29	32	37	48½	sw.	s.	w.	....	....	·65
6.	29·919	29·787	29·60	29·17	28·98	49	35	33·5	49	49	s.	s.	s.	....	....	·59
○ 7.	29·805	29·508	29·22	28·80	29·40	49	27	42	39	31	sw.	w.	nw.	·06	....	·36
8.	29·863	29·181	29·50	29·45	29·02	49	32	35	33	31	sw.	s.	n.	....	·05	....
9.	29·460	29·148	28·72	28·90	29·14	39	26	35·5	33	30	sw.	w.	n.	....	....	....
10.	29·714	29·663	29·40	29·50	29·52	50	25	28	30	30	w.	w.	e.	·08	·25	....
11.	29·210	29·022	28·70	28·89	28·80	51	43	45	34	34	w.	sw.	ese.	·07	·16	·28
12.	29·326	29·151	28·92	28·58	28·90	54	36	43	38	39	sw.	sw.	nw.	·62	·07	·22
13.	29·538	29·443	29·28	29·39	29·57	50	39	38	39	38	e.	s.	w.	·24	....	·02
☾ 14.	29·739	29·701	29·42	29·64	29·43	51	39	42	34	41	sw.	se.	s.	·16	·26	·02
15.	29·602	29·455	29·15	29·14	29·18	56	44	45	44	43	sw.	s.	se.	·26	·12	·08
16.	29·840	29·703	29·08	29·18	29·37	52	37	44	42	43½	sw.	w.	w.	·07	·35	·05
17.	30·241	29·951	29·56	29·57	29·84	47	24	39	43	43	w.	w.	w.	....	....	·26
18.	30·326	30·276	29·90	29·86	29·82	44	22	35	47	45	sw.	sw.	sw.	....	....	·09
19.	30·141	29·980	29·79	29·66	29·58	47	28	35	45	44	s.	s.	s.	....	....	·11
20.	29·769	29·695	29·36	29·41	29·42	49	28	43·5	45	45	s.	s.	w.	·03	....	....
● 21.	29·967	29·377	29·52	29·32	28·58	53	38	34	40	43	sw.	ssw.	sse.	·26	·10	·54
22.	29·396	29·263	28·80	28·38	28·35	47	31	39	40	44	sw.	sw.	ssw.	·01	·18	·09
23.	29·829	29·423	29·10	28·78	29·22	46	29	35	46	43½	sw.	wsw.	w.	·01	....	·08
24.	29·831	29·559	29·38	28·67	28·86	48	34	37	43	41½	sw.	s.	sw.	·10	....	·11
25.	29·945	29·775	29·38	29·19	29·33	50	27	34·5	40	39½	sw.	sw.	sw.	·06	·18	·07
26.	30·073	29·903	29·64	29·48	29·38	51	41	33·5	42	42½	sw.	ssw.	sse.	....	....	·10
27.	29·588	29·467	29·20	29·20	29·32	46	29	43	45	43	s.	ssw.	s.	·28	....	....
28.	29·883	29·730	29·40	29·70	29·74	45	21	33	41	39	nw.	wnw.	s.	....	·07	·08
☽ 29.	30·090	29·924	29·70	29·32	29·44	46	34	31	47	42	sw.	s.	sw.	·04	....	·14
30.	29·979	29·624	29·16	28·88	29·24	53	29	46	41½	39	w.	sw.	w.	·11	·20	·19
31.	29·919	29·510	29·53	29·41	29·30	52	39	35	39	40	s.	w.	s.	·14	·02	·20
Mean.	29·829	29·605	29·35	29·232	29·259	48·00	31·32	37·5	40·35	40·24				2·72	2·19	5·23

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XXI.—*Notes and Descriptions of a few Brachiopoda; including a Monograph of the French Liasic Spirifers.* By THOMAS DAVIDSON, Member of the Geol. Soc. of France, &c.

[With three Plates.]

1. *Observations on the Genus* Rhynchonella *of Fischer, with descriptions of new species.*

FOR that group of plaited *Terebratulæ* including such shells as *R. Loxiæ*, Fischer, *Vespertilio*, Brocchi, *octoplicata*, Sow., &c., the generic names of *Trigonella* and *Rhynchonella* were proposed by Fischer de Waldheim, in 1809; both genera comprise similarly organized forms and are synonyms of each other; and as the name *Trigonella* had already been used by prior authors to denote other objects, the term *Rhynchonella* alone can be advantageously preserved. The necessity of separating these shells from the smooth *Terebratulæ* was foreseen even by early naturalists. Morton* in 1712 seems to have been among the first to arrange his *Terebratulæ* into two *distinct* divisions; in the first he placed those species with a *truncated beak*; and in the second those in which the beak is *acute and entire*; these divisions corresponding the first to the genus *Terebratula*, the second to that of *Rhynchonella* of modern authors.

Davila† in 1767 likewise alluded to the distinction between these shells, and noticed the difference in their apophysary system; but Fischer claims the honour of having first introduced a distinctive appellation‡. Within the last few years other generic

* Nat. Hist. of Northumberland.

† Catalogue systématique et raisonné.

‡ Neglected however until 1847, when M. D'Orbigny re-established the genus, giving the date 1825, being ignorant of Fischer's prior paper, of the

names have also been proposed for these plaited *Terebratulæ,* such as *Hypothyris,* Phillips, *Cyclothyris* (M'Coy), *Atrypa* (M'Coy)*, *Hemithiris*† and *Acanthothiris,* D'Orb., &c.

Without entering into a full history of this genus, our present object is, principally to inquire if authors are really entitled to establish these different *genera;* if the organizations vary; and if the genus existed from the Silurian period up to the present day; points which require immediate investigation to prevent the confusion which is daily added to the nomenclature by authors adopting frequently at random one denomination instead of another. Are we entitled to follow M. D'Orbigny, who places, for example,

T. psittacea, *T. Wilsoni,* &c.	in his genus Hemithiris;
T. octoplicata, *T. concinna,* *T. tetrahedra,* &c.	in Fischer's genus Rhynchonella;
T. spinosa, *T. senticosa,* &c.	in his genus Acanthothiris?

On what principle is a genus among the Brachiopoda to be established? Is it merely from a slight dissimilarity of outward form, or is it from the important differences and peculiarities in the supports of the arms and other impressions left by the animal in the shell? The great value of these last was justly admitted by M. D'Orbigny, but not always attended to by that author.

The genus *Rhynchonella* may be characterized as follows:—

existence of which I was first informed by Mr. Morris, who had discovered the only copy in London in the library of the Linnæan Society; but Prof. King was the first to publish it, having also discovered the paper.

For more ample details on this subject I beg to refer to my work on British Brachiopoda, Part 1, 2 and 3, genus *Rhynchonella* (Palæontographical Society).

* The genus *Atrypa* was established by Dalman in 1827, his types being *A. reticularis, A. aspera, A. galeata, A. nucella, A. crassicosta, A. lenticularis.* This unfortunate so-called *genus* has of late been the subject of much discussion and variety of opinion among several authors, but on which our space will not allow us to enlarge at present; suffice it to say, that the three first-mentioned shells are well-known, and do not possess the characteristics of those now placed in the genus *Atrypa* both by Prof. M'Coy and M. D'Orbigny, many of which I am convinced are only *Rhynchonellæ.*

† We do not wish it to be understood, that we consider *all* the species placed by authors in the above-enumerated genera to belong to one single section, or that all the species placed in M. D'Orbigny's genus *Hemithiris* are true *Rhynchonellæ,* only those (among which are his types) partaking of the characters visible in *R. psittacea, Wilsoni,* &c. M. D'Orbigny places in his genus *Hemithiris* certain forms, such as *T. Schlotheimii,* which we believe to form a separate section, to which Prof. King has given the name *Camerophoria.*

Genus Rhynchonella, Fischer, 1809.

Animal small, generally attached to submarine objects by means of a pedicle issuing from the foramen placed under the beak of the larger valve. Shell inequivalve, variable in shape, wider than long, or longer than wide, circular or elongated; valves more or less convex, with or without a longitudinal mesial fold and sinus; beak acute, slightly or greatly recurved; no true area; foramen variable in its dimensions and form, placed under the beak, exposed or concealed, entirely or partially surrounded by a deltidium in two pieces, at times extending in the shape of a tubular expansion, at other times rudimentary, the foramen being completed by a small portion of the umbo. Surface striated, plaited, or costellated, rarely smooth; structure fibrous, unpunctuated, sometimes spiny; valves articulating by means of two teeth in the larger and corresponding sockets in the imperforated valve; apophysary system in smaller valve composed of two short, flattened and grooved lamellæ, separate and moderately curved upwards, attached to the inner side of the beak of smaller valve, and to which were affixed the free spiral fleshy arms*; a small central longitudinal septum more or less elevated is seen to extend along the bottom of the smaller valve from under the beak to about half or two-thirds the length of the shell, and separating the muscular impressions visible on either side.

Obs. We shall first inquire if these lamellæ supporting the free fleshy arms differ in the proposed genera above enumerated, taking, to begin with, the genus *Hemithiris*, of which M. D'Orbigny considers the recent *T. psittacea* to be the type, and in which he includes a great number of Palæozoic species, of which *T. Wilsoni* and *sub-Wilsoni*, D'Orb., may be mentioned as examples; but, strange to say, no representatives are stated to have lived during the *Tertiary*, *Cretaceous* and *Jurassic* periods, the genus having abounded, according to M. D'Orbigny, in the Palæozoic epoch, and after having become extinct for countless ages, reappeared in the shape of a solitary form in the recent state (*R. psittacea*). *R. spinosa* and *senticosa*, at one time placed in *Hemithiris*, were soon removed to form a distinct genus under the name of *Acanthothiris*; the genus *Rhynchonella* being stated not to occur in the recent period, but to have abounded in the Cretaceous, Jurassic, and in the Palæozoic period. From a minute examination of a number of the species distributed into these three genera by M. D'Orbigny, I cannot discover *any important* variation in the position or shape of the curved lamellæ above described, which are similar, and in all more or less developed; the mesial

* See Prof. Owen's anatomy of *T. psittacea*, Trans. of the Zool. Soc. vol. i. 2nd part.

septum is likewise perceptible, the muscular impressions being also much alike in this valve and only slightly modified in different species :—see our figures of *T. psittacea, T. octoplicata, T. sub-Wilsoni,* Pl. XIII. fig. 1, 2 & 8. Prof. M'Coy in 1844 noticed the form of these short lamellæ in *Ter. acuminata,* where I have seen them, but is mistaken when stating that he believes them to be the same in *T. hastata;* in this species they form a loop as in true *Terebratulæ,* as may be seen from the perfect specimen now preserved in the museum of the Geol. Survey; we must therefore conclude that there exists no important difference in the internal organization of the imperforated valve.

Much stress has been laid on the form of the beak, foramen, and deltidium in separating these shells into distinct genera; let us therefore consider the true value of these characters in some of the forms alluded to.

In all, the beak is acute and not truncated. In *R. psittacea* (type of his genus *Hemithiris*), M. D'Orbigny asserts the foramen to be without any deltidium; this is however a mistake: the deltidium is there; rudimentary, but existing, and partially circumscribing the foramen. In *Rhynchonella,* he mentions the foramen to be entirely surrounded by the *deltidium, which is stated to be tubular* (Pl. XIII. fig. 3); but this also is far from being the case in many species admitted and placed by that author in *Rhynchonella,* such as *R. concinna* (Pl. XIII. fig. 6), &c., wherein not only the deltidium is not tubular, but it does not even surround the foramen, a portion of which is completed by the umbo of the smaller valve*. Again, in many species, such as *R. tetrahedra* (Pl. XIII. fig. 7), *serrata, spinosa,* &c., the beak becomes in age so much recurved as to exhibit no visible foramen or deltidium, or passage for the muscular fibres of attachment, so that the shell probably became free, a circumstance well known to be peculiar to some extinct genera of Brachiopoda. It is therefore evident that the distinctions sought for cannot be found in either the *beak, foramen* or *deltidium,* in the shells composing these three genera proposed.

If we now examine the impressions left in the interior of the perforated valve, we shall find that these vary in some species placed in the same genus by M. D'Orbigny; that they are not peculiar to any of the types, or constant in any of the species forming the different genera: thus if we cast a glance on the interior of this valve of *R. psittacea* (*Hemithiris*) and many others believed to be *Rhynchonellæ,* we shall find no perceptible

* Mr. Woodward called my attention to some very young specimens of *R. concinna* (*Ter. Flabellulum,* Sow.), in which the deltidium exists only in the same rudimentary form as in the adult of the recent *R. psittacea.*

dissimilarities, while in some species of *Rhynchonella,* such as *R. lacunosa* (Pl. XIII. fig. 16), and others where the shell is very thick, great differences are visible, but which are in reality only specific, not generic.

M. D'Orbigny was probably not acquainted with the interior of this valve in his *H. sub-Wilsoni,* else he would have seen that these impressions there differ much more from those of *R. psittacea* than any he could point out between *R. psittacea* and his *Rhynchonella.*

From the above examination it is clear that no *sound reasons* have been brought forward by the different authors who have divided this type, to authorize the forming of separate genera; that the comparative study and minute inspection of the various species has not been entered into, and that the characters assigned as generic variations are inexact.

Therefore the question now remaining is, what name these shells ought to preserve: that of *Rhynchonella* is the oldest I am acquainted with; but if palæontologists can show good reason why such forms as *T. Wilsoni, sub-Wilsoni, cuboides,* &c. are not *Rhynchonellæ,* they cannot adopt that of *Hemithiris* (as justly observed by Prof. King), Prof. Phillips having prior to M. D'Orbigny proposed the name of *Hypothiris* for such shells as *R. cuboides.* The genus *Hemithiris,* D'Orb., and *Acanthothiris,* D'Orb., and all the other names above alluded to, must be placed among the synonyms. Before concluding these few remarks, we mention, that having been so fortunate as to discover in a quarry at Néhou, interiors of both valves of *R. sub-Wilsoni,* D'Orb., and internal casts of *R. Wilsoni,* Sow., in the Aymestry limestone of Sedgley, we have figured both in our plate, to show that there exist good grounds for retaining these two specific names, since the muscular impressions seem to vary in both.

Plate XIII. fig. 8 to 11. *R. sub-Wilsoni,* D'Orbigny *.
Plate XIII. fig. 12 to 14. *R. Wilsoni,* Sow.†

Rhynchonella Deslongchampsii, Dav. 1852. Pl. XIII. fig. 15.

Diagnosis. Shell inequivalve, irregularly lozenge-shaped, wider than long, convex; smaller valve divided into three almost equal lobes, the central one forming a greatly elevated mesial fold extending much beyond the lateral ones, which gradually slope to

* The position and form of the apophysary lamellæ were known to M. Deslongchamps many years back to be similar to those of *R. decorata.*

† Several good internal casts of this shell exist in the Museum of the Geol. Survey, which were placed at my disposal for examination by Prof. Forbes and Mr. Salter.

the margin. A sinus corresponds to the fold of the smaller valve, the perforated valve being rather less convex than the imperforated one; beak not much produced, recurved and acute, under which is seen a small circular foramen entirely surrounded and separated from the umbo by a deltidium in two pieces; beak-ridges well defined, leaving a slightly concave space or false area between them and the hinge-line, which last slightly indents the smaller valve; surface ornamented by a great number of small plaits, from fifty to sixty on each valve. Structure unpunctuated. Length 23, width 25, depth 14 lines.

Obs. This fine *Rhynchonella* was discovered by M. Deslongchamps in the liasic beds of Fontaine-étoupe-four near Caen, where it seems rare. M. Tesson has also obtained it in the same locality; it differs from *R. trilobata*, Münster, by its much smaller and more numerous plaits; this last being also an Upper Jurassic species, while our present form is liasic. The specimen figured is from the collection of M. Deslongchamps, to whom I have the pleasure of dedicating it.

RHYNCHONELLA BOUETI, Dav. 1852. Pl. XIII. fig. 4, 5.

Diagnosis. Shell inequivalve, wider than long, irregularly triangular and trilobed, the smaller valve being almost equally divided into three longitudinal portions, the central one forming an elevated mesial fold laterally contracted with a deep corresponding sinus in the larger valve, the front forming three almost equal and convex projections; beak not much produced, acute; foramen small and entirely surrounded and separated from the umbo by a deltidium in two pieces; beak-ridges well defined, leaving a slightly concave false area between it and the hinge-line, which last does not greatly indent the imperforated valve; surface ornamented by a variable number of simple acute plaits, about thirty in each valve—three, four or five forming the mesial fold and sinus; margin thickened all round. Structure imperforated. Length 12, width 15, depth 11 lines.

Obs. This shell occurs along with *R. obsoleta* in the Great Oolite of Ranville near Caen, where it is very common, and is easily distinguished from the last-named species, particularly by its much more elevated mesial fold gradually arising from the umbo till it acquires its greatest elevation near the front, while in *R. obsoleta* it will be found to exist at about the middle of the shell, the remaining portion sloping down to the front; the lateral parts are likewise more elongated and somewhat wing-shaped, a character not peculiar to *obsoleta*, which has a more simple and circular form.

2. *Note on the Genus* Terebratulina, *D'Orbigny.*

M. D'Orbigny judiciously separated such shells as *T. caput serpentis* from *Terebratula*, the loop in both these genera being quite distinct; but he adds (erroneously), that the shells of his genus *Terebratulina* are unprovided with deltidium. Impressed with this opinion, he places in the genus *Terebratula*, *T. substriata* of Schloth., a shell possessing even the external appearance of many species of his genus *Terebratulina*, but exhibiting a fine, fully developed deltidium. The interior of both *T. caput serpentis* and *T. substriata* are however perfectly similar, as any one may be convinced by a glance at our figures: this shows how one may err by resting too much importance on simple external appearances, or on the presence of a greater or smaller deltidium; thus leading us to separate shells which were undoubtedly inhabited by similar animals, and to class together animals evidently different. The genus *Terebratulina* did not therefore first occur in the Cretaceous period, as stated by M. D'Orbigny, but in the Jurassic epoch, where the oldest type of the genus is at present known.

Plate XIII. fig. 18, 18 *a*. *T. caput serpentis* (recent).
Plate XIII. fig. 17, 17 *a*. *T. substriata* (Schlotheim), Jurassic.

3. *Description of Three Species of* Terebratula.

Terebratula Haimeana, Dav. 1852. Pl. XIV. fig. 1, 1 *a*.

Diagnosis. Shell circular, inequivalve, depressed, wider than long; valves almost equally convex, deepest near the umbo; margin straight all round; no trace of mesial fold or sinus; beak small, recurved, and truncated by a small circular foramen nearly touching the umbo; beak-ridges well defined, leaving between them and the hinge-line a narrow false area. Surface smooth, with a few concentric lines of growth. Length 2 inches 4 lines, width 2 inches $6\frac{1}{2}$ lines, depth 1 inch 4 lines.

Obs. *T. Haimeana* is one of the largest Devonian *Terebratulæ* yet discovered, and is at once easily distinguished from *T. Caiqua*, De Verneuil, this last being nearly twice as long as wide, while the width of *T. Haimeana* is greater than its length; it is also distinct from *T. Archiaci* (Vern.), which is a much more compressed and elongated shell. I was so fortunate as to discover the species under notice in the Devonian beds of Paffrath near Cologne, some years ago, where it appears to be very rare, since M. de Verneuil, whose knowledge in these matters is so extensive, assures me he has not observed it in any other collection. I have great pleasure in naming it after M. J. Haime, whose researches, along with those of Prof. M.-Edwards, have thrown so much light on corals, both living and fossil.

Terebratula Morierei, Deslongchamps, MS. Pl. XIV. fig. 3 & *a, b.*

Diagnosis. Shell inequivalve, subpentagonal, longer than wide; valves convex, with a deep longitudinal angular sinus or depression in each valve extending from the beak and the umbo to the front, so that at the junction of the two sinuses in front, a deep angular notch is produced; beak rather short, recurved and truncated by a largish, circular, entire foramen; beak-ridges well marked, leaving between them and the hinge a well-defined false area; valves ornamented by numerous squamose, concentric, projecting, imbricated ridges, regularly and closely covering all the surface of the shell. Loop unknown, most probably short. Structure perforated. Length 9, width 8, depth 6 lines.

Obs. This curious form of *Terebratula* was discovered by M. Morière at St. Honorine des Perthes, near Port-en-Bessin in Normandy, in beds named by M. de Camont *Calcaire marneux de Port-en-Bessin,* which, according to M. Deslongchamps, correspond to the Inferior Oolite of Caen. This shell having been presented for M. Deslongchamps' examination, he at once perceived all its remarkable distinctive characters and forwarded his notes and illustrations (fig. 3 of our plate), requesting me to publish the species, which is dedicated to M. Morière the discoverer.

Ter. Morierei cannot be confounded with any other Jurassic form: at first sight it bears some resemblance to *T. coarctata,* but the deep sinus in both valves and the concentric squamose ridges at once distinguish it.

Plate XIV. fig. 3. From the collection of M. Morière.

Terebratula sphæroidalis, Sow. Pl. XIV. fig. 2.

In 1825, Sowerby described, under the name of *Ter. sphæroidalis,* a small globose shell found in the Inferior Oolite of Dundry; but in beds of the same age near St. Maixent (Dep. des Deux Sèvres) in France, this species attained such remarkable dimensions, that I considered it might be interesting to figure the largest individual I have as yet observed from that locality, now in the British Museum: this magnificent shell is almost circular, and of the dimensions of a billiard ball; length 24, breadth 22, depth 22 lines. Another in M. Bouchard's cabinet is only 2 lines smaller; and specimens of all dimensions have been obtained, some not exceeding 4 lines in length. One of the most curious peculiarities of this species consists in the variations it presents in the junction-line of the valves in front, which is often straight, variously curved, or indented; having no influence on the regular convexity of the shell, which extends uninterruptedly to the edge,

while in other specimens one or two slight depressions correspond to the undulations of the frontal margin. Another remarkable feature is the sudden stoppage of growth visible in many specimens, which has caused the remaining portion of the shell to deviate from the regular line, forming a raised rim all round, often presenting plaits not in existence before the sudden stoppage of growth. It would likewise appear, on examination of specimens collected by M. de Verneuil from several localities in Spain, such as Maranchon, Anchueta, Villas del Covo, &c., that this species first made its appearance in the Lias of that country, although no authentic specimen has been to my knowledge found out of the Inferior Oolite, in France or in England.

4. *On Spanish Cretaceous Brachiopoda.*

In the British Museum are preserved two species of cretaceous Brachiopoda from Santander, on the north coast of Spain, which have not hitherto been noticed by any of the few authors who have written on the fossils of that kingdom; a short description with figures may therefore not be devoid of interest.

TEREBRATELLA VERNEUILIANA, Dav. Pl. XIV. fig. 4.

Diagnosis. Shell inequivalve, circular, nearly as broad as long; valves nearly equally convex; no distinct mesial fold or sinus; beak produced, with a short, flat, triangular area, wherein is situated a large circular foramen, slightly indenting the beak, but much more the area, completed and separated from the umbo by a deltidium in two pieces; valves ornamented by a few large diverging costæ, augmenting in number by the intercalation of plaits at irregular distances from the beak and umbo, so that round the margin from fifteen to seventeen unequal costæ may be counted on each valve; the plaits are intersected at variable distances by well-marked concentric lines of growth. Structure punctuated. Length 6, width $6\frac{1}{2}$, depth 3 lines.

Obs. Four specimens of this species are preserved in the British Museum, all presenting the same characters. It is remarkable for the few plaits that ornament its surface. It approaches most in form to *T. Moreana*, D'Orb. (Pal. Tr. Ter. Crétacées, vol. iv. p. 117. pl. 516. fig. 13–19), but does not seem to present the mesial fold and sinus represented in M. D'Orbigny's figures of that species; the convexity of the valves in *T. Verneuiliana* not being interrupted by the projection of any of the plaits much above the level of the others; the position and dimensions of the foramen are likewise different.

Locality. The Upper Cretaceous beds of Santander, on the north coast of Spain.

PLATE XIV. fig. 4. Line showing the natural size; fig. 4 *a, b, c.* enlarged specimen in the British Museum.

Terebrirostra Bargesana, D'Orb. Pl. XIV. fig. 5.

T. Bargesana, D'Orb. 1851, Journal de Conchyliologie, vol. ii. p. 225. pl. 4. fig. 2–5.

Diagnosis. Shell inequivalve, much elongated; beak prolonged, tapering and truncated by a circular foramen; area long, triangular and edged; deltidium narrow, partly surrounding the foramen; valves unequally convex, the largest most so; no mesial fold or sinus, a slight depression existing towards the margin of the smaller valve. Surface ornamented by a number of small rounded costæ rarely bifurcated, but augmenting by the intercalation of costæ at variable distances from the beak and umbo. Surface punctuated. Length 12, width 9, depth 7 lines.

Obs. Eight specimens of this shell are preserved in the collection of the British Museum, which we have considered identical with M. D'Orbigny's lately described species, not having been able to detect any distinctive character, except its smaller dimensions, which may be due to local circumstances. The larger valve exceeds the smaller one by one-fourth more in length, arising from the elongation of the beak, but in younger shells the disproportion is much less.

T. Bargesana is found in the Upper Cretaceous beds of Santander (Spain), associated with *T. Verneuiliana.* In France it was first discovered by the Abbé Bargès between Bédoule and Cassis (Bouches-du-Rhone).

Plate XIV. fig. 5. From a specimen in the British Museum.

5. *On French Liasic* Thecideæ.

Prior to the publication of my Monograph of British Liasic and Oolitic Brachiopoda in 1851, no *Thecideæ* had been noticed in the Lias; M. D'Orbigny does not mention any. In the work alluded to we described and figured four, found by Mr. Moore in the neighbourhood of Ilminster; viz. *Th. Moorei, Bouchardii, rustica,* and *triangularis,* this last being likewise common to the Inferior and Great Oolite. In the Lias of Normandy two forms have occurred; one is our *Th. Bouchardii*; the other, probably new, was lately found along with *Spirifer Tessoni* at May near Caen by M. Deslongchamps, who forwarded several specimens for my examination and publication.

Thecidea Deslongchampsii, Dav. 1852. Pl. XIII. fig. 6, 7, 8, 9.

Diagnosis. Shell inequivalve, longer than wide, irregularly oblong; fixed to submarine objects by the flattened beak of the larger valve moulding itself on the object to which it is attached; the remaining portion of this valve is regularly convex, and deepest near the hinge; area short, wide and irregular; deltidium

visible, but not very well defined; smaller valve as wide as long, operculiform, slightly convex and flattened; surface smooth, interrupted only by a few concentric lines of growth. Structure punctuated; hinge-line straight; valves articulating by means of two teeth in the larger valve and corresponding sockets in the smaller one. In the interior of the dental valve, beneath the deltidium, three short lamellar processes are seen to occupy about a fifth of the length of the shell, the central one being the longest and most elevated; the other two, appearing at the base of the dental plates, converge gradually towards the central one; a longitudinal rounded elevation extends also along the middle of the valve. In the interior of the smaller one on either side of the sockets a wide, thickened, raised, granulated margin (*limbe*) surrounds the shell, which on reaching the middle of the front directs itself longitudinally inwards under the form of a narrow, acute, elevated crest, and not much longer than half the length of the valve; on either side of this ridge and the inner edge of the margin are seen two other rounded ridges covered with large granulations. Dimensions variable. Length 2, width $1\frac{1}{2}$, depth $1\frac{1}{2}$ lines.

Obs. In external shape this species reminds us of several cretaceous forms, such as *Thecidea tetragona*, Rœmer, *rugosa*, D'Orb. &c.; yet it is quite distinct from any, by the more simple arrangements in the interior of its smaller valve, where none of those numerous sinuated ridges exist.

The arrangement in the interior of the smaller valve of the form under notice bears some resemblance to a few specimens of *Thecidea rustica*, from the Lias of Ilminster, but of which unfortunately only the smaller valve is known; and from the inspection of more than a hundred specimens found by Mr. Moore, none seem to have attained above a third of the dimensions presented by the French shell. There appears to be also a dissimilarity in the shape of the central ridge, which in *Thecidea Deslongchampsii* is narrow, and acute in its whole length in the specimens I have been able to examine, while in *Th. rustica* it apparently forms a double ridge united at the extremity, with an intermediate depression. We have therefore ventured to distinguish the large French *Thecidea* by the name of *Th. Deslongchampsii*, that gentleman having first observed the species at May near Caen.

PLATE XIV. fig. 6. Natural size. Fig. 6 *a*, 7, 7 *a*, *b*, 8 & 9. Enlarged illustrations.

THECIDEA BOUCHARDII, Dav. Pl. XIV. fig. 10, 11, 12.

Thecidea Bouchardii, Dav. British Fossil Brachiopoda (Pal. Soc.), part 3. p. 14. pl. 1. fig. 15, 16 (1851).

Diagnosis. Shell inequivalve, transversely oval, much wider

than long; attached by the whole surface of its larger valve to submarine bodies; area triangular; deltidium well defined; unattached valve slightly convex, but flattened; surface smooth and punctuated.

Obs. I mentioned in 1851 that M. Tesson had met with a very large liasic *Thecidea* closely resembling our *Th. Bouchardii*, found by Mr. Moore in the Lias of Ilminster, but the disproportion in size between the specimens discovered at that period made me uncertain as to the identity, of which I have now not the smallest doubt, Mr. Moore having lately obtained in the same locality several adult specimens of *Th. Bouchardii*, quite agreeing with the French shell, and even slightly exceeding it in dimensions.

Thecidea Bouchardii was found by M. Tesson attached to a *Spirifer Tessoni*, in the Lias of Fontaine-étoupe-four near Caen; it measures, length $2\frac{1}{2}$ lines, width 4 lines.

Plate XIV. fig. 10. M. Tesson's specimen, natural size; 10 *a*. enlarged illustration. Fig. 11. Our English specimen, natural size; 11 *a*. the same, enlarged. Fig. 12. A very adult specimen, natural size, found near Ilminster by Mr. Moore, attached to a *Rhynchonella serrata*; it measures, length 3, width 4 lines.

Thecidea triangularis, D'Orb. Pl. XIV. fig. 13.

Thecidea triangularis, D'Orb. Prodrome, vol. i. p. 316 (1849); Dav. Brit. Fossil Brach. part 3. p. 14. pl. 1. fig. 11, 12 (1851).

This species is only here introduced on account of its being found in England in the Lias and Inferior Oolite; while in France it has only hitherto been discovered in the Great Oolite of Ranville near Caen, where the shell is not very rare, attached to shells and corals. The illustration fig. 13 is from a specimen found in that locality.

The three above-described *Thecideæ* comprise all the species of the genus with which I am acquainted at present from the Jurassic formations of France.

6. *Monograph of French Liasic Spirifers.*

The French Liasic Spirifers are so remarkable in shape and specific characters, some being new and others little known, that in order to meet the wishes expressed by several palæontologists, I here beg to offer a short monograph accompanied by correct illustrations of all the species known as occurring in that kingdom.

The genus *Spirifer*, established in 1818 by Sowerby, contains many species, which may advantageously be divided into four sections, from differences existing chiefly in the structure ob-

servable in the interior of the perforated valve; but all those found in the Lias appear to belong to one group, presenting the same internal dispositions of the septa in the larger valve and spirals in the smaller one*; in all, the structure is punctuated and spinose, and in different species varying only in the size of the punctures and position and dimensions of the tubular spines. To this group M. D'Orbigny has applied the generic appellation of *Spiriferina*†, and it has also been clearly established, that Spirifers possessing this structure were not only peculiar to the Lias, as at one time supposed, but that they occur likewise in older rocks. Liasic Spirifers appear to have been first noticed by Knorr in 1755, and Torrubia in 1773; these authors having illustrated *Sp. rostratus,* and Walcot in 1799 *Spirifer Walcotti*; it was only however in the nineteenth century that these Spirifers were properly named and described, but unfortunately too much subdivided by various authors, who did not perceive that they were making distinct species of mere varieties.

Our researches have brought to light seven well-defined French Liasic Spirifers, all described in this monograph.

M. D'Orbigny, in his 'Prodrome,' gives a list of seven Liasic Spirifers, three only of which are properly named; of the remaining four, three are synonyms of *Sp. rostratus,* so that

* These have been fully described in my Monograph of British Oolite and Liasic Brachiopoda, Part 3. p. 22, published by the Pal. Soc.

† M. D'Orbigny divides the family of *Spiriferidæ* into five genera, viz.—1. *Cyrthia*; 2. *Spirifer*; 3. *Spiriferina*; 4. *Spirigerina*; 5. *Spirigera.* The three first only are in our view true Spirifers. In *Cyrthia,* M. D'Orbigny states the fissures to be covered by a *deltidium*; in the second, *Spirifer,* and third, *Spiriferina,* he mentions the fissure to be triangular, open in all its extent, *and without deltidium.* We cannot here help expressing our surprise at such an assertion from such an observer as M. D'Orbigny; we have no hesitation in stating our conviction to be, that in the perfect state *all* Spirifers were provided with a deltidium, and only wanting from the incomplete state of most specimens; but we have often noticed it in many species belonging to M. D'Orbigny's genera *Spirifer* and *Spiriferina*; it is not rare to find it preserved in many Liasic species from Normandy, and we have figured it in our Monograph of British Liasic and Oolitic Brachiopoda, it being composed of two pieces circumscribing a part of the orifice through which the muscular fibres of the pedicle issued. M. Bouchard has seen it preserved on some specimens of *Sp. Verneuilii* from Ferque, and I figured a specimen of the same in Lamarck's collection (Ann. and Mag. Nat. Hist. June 1850). It is beautifully preserved in many specimens of *Sp. speciosus* from the Eifel. M. de Verneuil figured it in *Spirifer Pellico*: in fact, in no case do I believe the triangular fissure was entirely open for the passage of the muscular fibres. In one set of Spirifers, such as *Sp. trapezoidalis* (*Cyrthia*), it covered all the fissure, but in others only a portion. In *Spiriferina* M. D'Orbigny states the deltidial fissure to be edged by a rim (*bourrelet*), which he gives as a distinctive character from *Spirifer.* This is another mistake; the *rim* alluded to exists in all Spirifers (see Cours élémentaire de Palæontologie, vol. ii. p. 86).

M. D'Orbigny seems only acquainted with five; we have added two others which are by no means the least interesting of the lot, viz. *Sp. Tessoni* and *Sp. Deslongchampsii, Sp. Tessoni* and *rostratus* being the two largest of the tribe peculiar to the Lias. In Great Britain we are acquainted with only three of these French species, viz. *Sp. rostratus, Walcotti* and *Münsteri*; but another is there found, described by us under the name of *Sp. Ilminsteriensis. Sp. Linguiferoides* and *Chilensis*, Forbes, as well as *Sp. tumidus* (Coquand and Bayle), *Sp. Hartmanni* and *verrucosus*, Zieten, as we have stated, seem to us only varieties of *Sp. rostratus*; and *Sp. Beirensis* (Sharpe) is probably also another variation of the same. We are therefore acquainted with only eight or nine species of *Spirifer* from the Liasic period, seven of which are found in France, some bearing much external resemblance to certain Palæozoic forms.

Spirifers were most abundant in species in the Silurian, Devonian, and Carboniferous periods, less so in the Permian and Lias, and not positively known to occur higher up in the series, although I should not be surprised if they were found higher up. The limits assigned to certain genera are often contradicted by unexpected discoveries: within the last few years *Producta* have been shown to occur in the Silurian rocks, *Leptænæ, Thecideæ* in the Lias, and other genera have likewise been made to descend or to rise in the series.

1. Spirifer rostratus, Sch. sp. 1813. Pl. XIV. fig. 14, 15. Pl. XV. fig. 11.

Terebratulites rostratus, Schlotheim, Beiträge zur Nat. p. 73, 1813, and Nach. zur Petrefact. pl. 16, 1822.

Diagnosis. Shell inequivalve, variable in shape, transversely oval or elongated, with or without a mesial fold and sinus, smooth or ornamented by numerous small shallow rounded costæ, never extending over the mesial fold or sinus; beak more or less developed, recurved or straight; deltidium in two pieces; area well-defined, variable in dimensions, but whose limits are marked by the absence of spines; hinge-line shorter than the width of the shell; structure punctuated and spinose; spines irregularly disposed over its surface; dimensions variable. Length 19, width 22, depth 12 lines.

Obs. This species is so well known that we need not enter into any lengthened details, but merely remark that much larger specimens have been collected in England than in France; one in particular, discovered at Ilminster by Mr. Moore, measured, length 28, width 30, depth 17 lines. *S. rostratus* is found in many countries, but especially abundant in the Liasic quarries in

the neighbourhood of Caen. M. de Verneuil has given me specimens lately collected by himself in the Lias of Maranchon (Spain).

PLATE XIV. fig. 14, 15. illustrate two varieties of this species from the Lias of the neighbourhood of Caen.

PLATE XV. fig. 11. A remarkable malformation found by M. Deslongchamps, and belonging to his collection.

2. SPIRIFER WALCOTTI, Sow. 1823. Pl. XV. fig. 10.

Spirifer Walcotti, Sow. Min. Con. vol. iv. p. 106. pl. 377. f. 12, 1823.

Diagnosis. Shell inequivalve, variable in shape, generally transversely oval, with elevated mesial fold and four lateral rounded plaits on each side corresponding to a sinus and plaits in the large valve; beak more or less recurved; area narrow; deltidium in two pieces; hinge-line shorter than the width of the shell; surface punctuated and spinose. Length 14, width 18, depth 11 lines.

Obs. This species is easily distinguished from *Sp. rostratus* by its well-defined mesial fold and few large lateral plaits. It abounds in the Lias of Avalon in Burgundy, and in many other localities. The largest specimen I have seen was found in England by Mr. Moore; it measured, length 19, width 24, depth 14 lines.

PLATE XV. fig. 10. From the Lias of Avalon.

3. SPIRIFER MÜNSTERI, Dav. 1851. Pl. XV. fig. 8, 9.

Diagnosis. Shell inequivalve, variable in shape, wider than long, mesial fold in smaller valve, acute and elevated, and corresponding to a deep sinus in larger one, with six or seven acute plaits on each side of the mesial fold and sinus; beak more or less produced, elevated and recurved, or projected backwards and straight; area large, triangular, with deltidium in two pieces; hinge-line shorter than the width of the shell; structure punctuated and spinose. Length 7, width 11, depth 10 lines.

Obs. This remarkable species was confounded in 1832 with Sowerby's *Sp. octoplicatus,* which is a Carboniferous species; it is distinguished from *Sp. Walcotti* by the form of its beak, area, and the greater number of its plaits; it is also a much smaller shell, rarely exceeding 7 lines in length and 9 in width: the dimensions of the area are very variable in this species; in some specimens it is small, its width not exceeding a fourth of its length, while in other cases the length and width are almost equal. *Sp. Münsteri* is not so abundant as *Sp. rostratus* and *Walcotti,* but is often met with at Fontaine-étoupe-four near

Caen, where many remarkable specimens have been found by M. Deslongchamps, Bouchard, Tesson and others.

PLATE XV. fig. 8. A specimen from Fontaine-étoupe-four, in the coll. of M. Bouchard. Fig. 9. Another from the same locality.

4. SPIRIFER OXYPTERUS, Buv. Pl. XV. fig. 5, 6, 7.

Spirifer oxypterus, Buvignier, 1843, Mém. de la Soc. Philom. de Verdun, tome ii. p. 14. pl. 8. f. 8; Géol. des Ardennes, p. 534. pl. 5. f. 5.

Diagnosis. Shell inequivalve, variable in shape, transverse; valves convex; beak more or less produced and recurved; area short; deltidium in two pieces; hinge-line considerably exceeding the width of the shell, extending in the shape of wings; surface ornamented by a wide elevated mesial fold in smaller valve and corresponding sinus in larger one, with from four to six rounded lateral costæ on each side of the fold and sinus; structure punctuated and spinose; dimensions variable. Length 11, width 19, depth 8 lines.

Obs. This remarkable species was first brought to light by M. Buvignier, who discovered it in the Liasic beds of Carignan Sachy (Ardennes), where it is rare, and is easily distinguished from all the other Liasic Spirifers by its wings, reminding us of many Palæozoic forms in which the hinge-line greatly exceeds the width of the shell. M. Tesson likewise found this species many years ago in the Lias of Fontaine-étoupe-four near Caen, and I was so fortunate as to pick up another specimen at Croisilles near Caen.

PLATE XV. fig. 5. illustrates the original type obligingly sent me by M. Buvignier; it is from the Ardennes. Fig. 6. The specimen found by myself at Croisilles. Fig. 7. M. Tesson's specimen from Fontaine-étoupe-four.

5. SPIRIFER SIGNIENSIS, Buv. Pl. XV. fig. 3.

Spirifer Signiensis, Buv. 1843, Mém. Soc. Philom. de Verdun, t. ii. p. 14. pl. 5. f. 9; Géol. des Ardennes, p. 534. pl. 4. f. 9.

Diagnosis. Shell inequivalve, transversely oval; valves convex, but depressed, ornamented by a well-defined mesial fold and sinus, nearly twice the width of the lateral plaits, these last varying from eight to nine on each side of the mesial fold and sinus; beak produced, not much recurved; area narrow, triangular; deltidium in two pieces; hinge-line shorter than the width of the shell. Surface punctuated and spinose; dimensions variable. Length 8, width 13, depth 14 lines.

Obs. This interesting species was discovered by M. Buvignier

in the Liasic beds of Signy-le-Petit, and well described by that author, but incorrectly figured by the artist; to which point M. Buvignier called my attention by sending me the correct illustrations here given, and a plaster-of-Paris cast both of this and of his *Sp. oxypterus,* wherein the well-defined mesial fold formed by a single plait, omitted in the original figures, is clearly exposed, and which character fully distinguishes it from my *Spirifer Tessoni,* as admitted by M. Buvignier, to whose opinion I submitted my observations.

PLATE XV. fig. 3. From a drawing sent me by M. Buvignier; the specimen was found in the Lias of the Ardennes.

6. SPIRIFER TESSONI, Dav. 1852. Pl. XV. fig. 1, 2.

Diagnosis. Shell inequivalve, transversely oval; valves convex, ornamented by a variable number of small plaits, from forty to sixty on each valve, more than half of which are formed by the bifurcation and intercalation of plaits, at variable distances from the beak and umbo; the mesial fold is more or less produced, gradually arising from the lateral portion of the valve, and ornamented by a variable number of plaits in width equalling those ornamenting the rest of the surface; beak produced, nearly straight; area triangular; deltidium in two pieces; hinge-line shorter than the width of the shell; structure punctuated and spinose; numerous concentric lines of growth intersecting the longitudinal radiating plaits; dimensions variable. Length $22\frac{1}{2}$, width 35, depth 16 lines.

Obs. This magnificent *Spirifer,* by far the largest of the tribe met with in the Lias of France, has been known to me these several years, and was first discovered by M. Tesson and Deslongchamps in the Liasic beds of Fontaine-étoupe-four, whence not more than about half-a-dozen specimens had been procured until lately, when M. Deslongchamps was so fortunate as to obtain several from the Lias near May in the neighbourhood of Caen, from which place the largest specimen was brought by that learned and indefatigable palæontologist. This species has also been encountered in the first-named locality by MM. Morière and Breville. It is at once distinguished from all the other Spirifers by its dimensions and numerous small bifurcated plaits.

PLATE XV. fig. 1, From a perfect specimen found in the Lias of Fontaine-étoupe-four near Caen, by M. Tesson. I am indebted to my friend M. Bouet for the drawings of this shell. Fig. 2. The largest specimen of this species yet discovered, and belonging to M. Deslongchamps; that gentleman prepared the drawing of this shell, every plait of which he measured and most correctly represented. The specimen is also from May near Caen.

7. Spirifer Deslongchampsii, Dav. Pl. XV. fig. 4.

Unfortunately only the smaller valve of this curious species has been collected as yet by M. Bouchard, in the Lias of Fontaine-étoupe-four; its description must consequently be very incomplete; but it seems to differ from all the other forms we have examined by its shape and structure.

Diagnosis. Shell inequivalve, transverse, ornamented by fifteen or sixteen costæ, several of which arise from bifurcation and intercalation at variable distances from the umbo; no real mesial fold; four or five of the costæ slightly projecting above the level of the lateral ones; structure punctuated and spinose. Length 7, width 10 lines.

Obs. The structure of this shell is very beautifully exposed on the specimen under notice; it is closely and largely punctuated all over, but it is only on the upper surface of the rounded costæ that the tubular spines are implanted, few in number, and very wide in circumference at their base; none appear on the sides or the grooves left between the plaits, as in other Liasic Spirifers. The spines are broken, unfortunately, near their base, but are so distinct and so few in number that they can easily be counted without the use of the lens. This remarkable shell was kindly forwarded to me by my friend M. Bouchard for description and illustration.

Plate XV. fig. 4. The line represents the real width of the specimen. Fig. 4 *a.* The valve enlarged 4 times. Fig. 4 *b.* A fragment considerably magnified; one of the spines is restored.

EXPLANATION OF THE PLATES AND FIGURES.

Plate XIII.

Fig. 1. 1 *a, b. Rhynchonella psittacea* (recent): 1. interior of small valve; 1 *a.* interior of large valve; 1 *b.* section of small valve.
— 2. *Rhynchonella octoplicata,* Sow.; interior of small valve.
— 3. Do. do. ; beak, foramen, and deltidium (which is tubular in this species).
— 4. Do. *Boueti,* Dav.; interior of perforated valve.
— 5. 5 *a.* Do. do. ; exterior.
— 6. Do. *concinna,* Sow.; beak and foramen, which is not entirely surrounded by the deltidium.
— 7. Do. *tetrahedra,* Sow.; beak, which is so much recurved as to show no foramen or deltidium.
— 8. Do. *sub-Wilsoni,* D'Orb.; interior of smaller valve enlarged.
— 9. Do. do. ; interior of larger valve, enlarged.
— 10. Do. do. ; a specimen, nat. size, of larger valve.
— 10 *a.* Do. do. ; a gutta percha cast made from fig. 10, to show the difference presented in similar casts of *T. Wilsoni,* fig. 14 B.

Fig. 11. 11 *a.* *Rhynchonella sub-Wilsoni*, D'Orb.; exterior, nat. size.
— 12. 12 *a.* Do. *Wilsoni*, Sow.; exterior, from the Aymestry limestone of Sedgley.
— 13. Do. do. ; interior of larger valve (enlarged).
— 14. Do. do. ; internal cast, A. of smaller valve, B. of larger one.
— 15. 15 *a b.* Do. *Deslongchampsii*, Dav. Lias of Normandy.
— 16. Do. *lacunosa*, Schl.; interior of larger valve.
— 17. *Terebratulina substriata*, Schl.; (Jurassic) exterior.
— 17 *a.* Do. do. ; interior of smaller valve.
— 18. Do. *caput serpentis*; exterior.
— 18 *a.* Do. do. ; interior of smaller valve.

PLATE XIV.

Fig. 1. 1 *a.* *Terebratula Haimeana*, Dav. Dev., Paffrath near Cologne.
— 2. 2 *a.* Do. *sphæroidalis*, Sow. Inferior Oolite, St. Maixent (France).
— 3. 3 *a, b.* Do. *Morierei*, Deslongchamps. Inferior Oolite, Normandy.
— 4. 4 *a, b.* *Terebratella Verneuiliana*, Dav. (Cretaceous) Spain; the line indicating the nat. size.
— 5. 5, *a.* *Terebrirostra Bargesana*, D'Orb. (Cretaceous) Spain.
— 6. *Thecidea Deslongchampsii*, Dav.; nat. size. Lias, Normandy.
— 6 *a.* Do. do. ; enlarged.
— 7. 7 *a, b, c.* *Thecidea Deslongchampsii*; another specimen much enlarged.
— 8. *Thecidea Deslongchampsii*; interior of attached valve, enlarged.
— 9. Do. do. ; interior of smaller valve, enlarged.
— 10. *Thecidea Bouchardii*, Dav.; nat. size. Lias, Fontaine-étoupe-four.
— 10 *a.* Do. do. ; enlarged.
— 11. Do. do. ; nat. size; a British specimen.
— 11 *a.* Do. do. ; the same, enlarged.
— 12. Do. do. ; the largest specimen known from the Lias.
— 13. Do. *triangularis*, D'Orb. Great Oolite, Ranville near Caen.
— 13 *a.* Do. do. ; enlarged illustration of Ilminster specimen.
— 14. *Spirifer rostratus* (Schl.); a smooth var.
— 15. Do. do. ; a var. with rounded plaits.

PLATE XV.

Fig. 1. 1 *a, b, c.* *Spirifer Tessoni*, Dav. Lias, Fontaine-étoupe-four.
— 2. *Spirifer Tessoni*. Lias, May.
— 3. 3 *a, b, c.* *Spirifer Signiensis*, Buv. Lias, France; type of the species.
— 4. 4 *a, b.* *Spirifer Deslongchampsii*, Dav. Lias, France.
— 5. *Spirifer oxypterus*, Buv.; type of the species.
— 6. 6 *a.* *Spirifer oxypterus*. From Croisilles.
— 7. 7 *a, b.* Do. do. From Fontaine-étoupe-four.
— 8. 8 *a, b.* Do. *Münsteri*, Dav. Lias, France.
— 9. 9 *a.* Do. do. Lias, France.
— 10. *Spirifer Walcotti*, Sow. Lias, France.
— 11. 11 *a, b.* *Spirifer rostratus*, Schl.; a malformation in M. Deslongchamps' collection.

XXII.—*A Catalogue of British Spiders, including remarks on their Structure, Functions, Œconomy, and Systematic Arrangement.* By John Blackwall, F.L.S.

[Continued from p. 22.]

141. *Neriëne munda.*

Neriëne munda, Blackw. Linn. Trans. vol. xviii. p. 642.
Argus mundus, Walck. Hist. Nat. des Insect. Apt. t. iv. p. 511.

Adult males of this species occur in May and June among rank herbage growing in woods about Llanrwst, and in 1840 I received specimens of the same sex from Miss Ellen Clayton, who took them near Garstang, in Lancashire.

142. *Neriëne tibialis.*

Neriëne tibialis, Blackw. Lond. and Edinb. Phil. Mag. Third Series, vol. viii. p. 485.

A few adult males of *Neriëne tibialis* were taken in March 1835 under stones at Oakland.

143. *Neriëne cornuta.*

Neriëne cornuta, Blackw. Lond. and Edinb. Phil. Mag. Third Series, vol. iii. p. 190; Research. in Zool. p. 372.
Theridion bituberculatum, Wider, Museum Senckenb. B. i. p. 222. taf. 15. fig. 2.
Argus bituberculatus, Walck. Hist. Nat. des Insect. Apt. t. ii. p. 363.

In May 1833 I discovered males of this remarkable spider, which had acquired their full development, on rails and gates at Oakland, and have since met with both sexes in the same locality and at Crumpsall Hall.

I have included the *Theridion bituberculatum* of M. Wider, and the *Argus bituberculatus* of M. Walckenaer, which appear to be identical, among the synonyma of this species, although they are represented as differing from it and from each other in the relative length of their legs, and also somewhat in colour. M. Wider, in his description of *Theridion bituberculatum,* states that "die Beine sind ziemlich kurz und nicht sehr ungleich, das dritte Paar am kürzesten, dann folgt das vierte, dann das erste und das zweite ist das längste;" and M. Walckenaer, in treating upon the structure of *Argus bituberculatus,* remarks that "les pattes sont peu allongées, la première paire est la plus longue, ensuite la seconde, la troisième est la plus courte." Now as regards the legs of *Neriëne cornuta,* the anterior and posterior

pairs, which are the longest, are equal in length, and the third pair is the shortest; it is probable, however, that these discrepancies may be more apparent than real, for, without measurement, it is difficult to ascertain the relative length of the limbs of spiders, especially when they do not differ greatly in longitudinal extent, and this difficulty is chiefly occasioned by the unequal breadth of the cephalo-thorax, to which they are articulated.

144. *Neriëne apicata.*

Neriëne apicata, Blackw. Annals and Mag. of Nat. Hist. Second Series, vol. vi. p. 339.

A male of *Neriëne apicata,* having the palpal organs completely developed, was taken on a rail at Oakland in February 1850.

145. *Neriëne rubens.*

Neriëne rubens, Blackw. Lond. and Edinb. Phil. Mag. Third Series, vol. iii. p. 189; Research. in Zool. p. 370.
Theridion cheliferum, Wider, Museum Senckenb. B. i. p. 237. taf. 16. fig. 4.
Argus cheliferus, Walck. Hist. Nat. des Insect. Apt. t. ii. p. 364.

The palpi of the male of this species, which is found among heath and grass in Denbighshire, Yorkshire, and the south of Lancashire, are very peculiar in structure; M. Wider has well remarked that "sie haben viel Aehnlichkeit mit der Scheere der Krebse, nur dass ein eigentlicher Daumen fehlt" (Museum Senckenbergianum, B. i. p. 238).

146. *Neriëne nigra.*

Neriëne nigra, Blackw. Research. in Zool. p. 378.

Males and females of *Neriëne nigra* were obtained in the autumn of 1833 on posts and rails at Oakland and Crumpsall Hall. The attention of observers is directed to this common aëronautic spider by the frequency of its aërial excursions.

147. *Neriëne graminicola.*

Linyphia graminicola, Sund. Vet. Acad. Handl. 1829, p. 213.
Theridion rubripes, Hahn, Die Arachn. B. i. p. 92. tab. 22. fig. 70.
Micryphantes rubripes, Koch, Die Arachn. B. iv. p. 121. tab. 142. fig. 328, 329.
Argus graminicolis, Walck. Hist. Nat. des Insect. Apt. t. ii. p. 351.

An adult male of this spider, which has the essential characters of a *Neriëne,* was taken among herbage in a field at Southgate in May 1850, and is in Mr. Walker's cabinet.

148. *Neriëne longipalpis.*

Linyphia longipalpis, Sund. Vet. Acad. Handl. 1829, p. 212; Vet. Acad. Handl. 1832, p. 259.
Erigone atra, Blackw. Lond. and Edinb. Phil. Mag. Third Series, vol. iii. p. 195; Research. in Zool. p. 324.
—— *dentipalpis,* Koch, Die Arachn. B. viii. p. 90. tab. 278. fig. 659, 660.
Argus longimanus, Walck. Hist. Nat. des Insect. Apt. t. ii. p. 346.

This species is widely distributed in England and Wales, and is remarkable for its ascents into the atmosphere, and for the extraordinary organization of the cephalo-thorax and its appendages in the male. The sexes pair in June, and the female deposits 6 or 7 spherical eggs of a pale yellowish white colour in a subglobose cocoon of white silk of a slight texture, which measures about $\frac{1}{10}$th of an inch in diameter, and is usually attached to the inferior surface of stones.

It is a fact deserving of notice, that *Neriëne longipalpis* can preserve an active state of existence for some days when submerged in water.

I have not included the *Theridion dentipalpe* of M. Wider (Museum Senckenbergianum, B. i. p. 248. taf. 17. fig. 1) among the synonyma of this spider, because it appears to differ from it in structure and colour; on the latter particular, however, little stress can be laid, as the specimens collected by M. Wider were preserved in spirit of wine.

149. *Neriëne fusca.*

Neriëne fusca, Blackw. Research. in Zool. p. 382.

Neriëne fusca occurs on rails and under stones in Lancashire and Denbighshire. It pairs in the month of June.

150. *Neriëne gibbosa.*

Neriëne gibbosa, Blackw. Linn. Trans. vol. xviii. p. 653.
Argus gibbosus, Walck. Hist. Nat. des Insect. Apt. t. iv. p. 513.

Specimens of this spider were discovered under stones in a moist pasture at Oakland in May 1838.

151. *Neriëne tuberosa.*

Neriëne tuberosa, Blackw. Linn. Trans. vol. xviii. p. 654.
Argus tuberosus, Walck. Hist. Nat. des Insect. Apt. t. iv. p. 514.

In May 1838 an adult male of this species was found under a stone in a moist pasture at Oakland.

152. *Neriëne trilineata.*

Neriëne trilineata, Blackw. Linn. Trans. vol. xix. p. 124.
Linyphia bucculenta, Sund. Vet. Acad. Handl. 1831, p. 109.
—— *reticulata,* Walck. Hist. Nat. des Insect. Apt. t. ii. p. 260.
Theridion reticulatum, Hahn, Die Arachn. B. ii. p. 39. tab. 54. fig. 124.
Bolyphantes trilineatus, Koch, Uebers. des Arachn. Syst. erstes Heft, p. 9; Die Arachn. B. viii. p. 67. tab. 272. fig. 641.

Neriëne trilineata is not uncommon in the neighbourhood of Manchester, where it conceals itself under stones; and Mr. R. H. Meade has met with it in Yorkshire.

I am doubtful whether the spider named by me *Neriëne graminicolens* (Transactions of the Linnæan Society, vol. xix. p. 125) is not a variety of this species, from which it differs chiefly in not having dark annuli on the legs and palpi.

The contraction and expansion of the dorsal vessel are very apparent in *Neriëne graminicolens,* which occurs among grass and coarse herbage in pastures at Oakland, and is probably identical with the *Linyphia cellulana* of Prof. Sundevall (Vet. Acad. Handl. 1831, p. 108).

153. *Neriëne rubella.*

Neriëne rubella, Blackw. Linn. Trans. vol. xviii. p. 648.
Micryphantes isabellinus, Koch, Die Arachn. B. viii. p. 109. tab. 282. fig. 676–678.

This species, which bears a strong resemblance to *Neriëne rubens,* is found under stones and on plants growing in woods at Oakland. The male has the palpal organs fully developed in October.

154. *Neriëne variegata.*

Neriëne variegata, Blackw. Linn. Trans. vol. xviii. p. 650.
Argus variegatus, Walck. Hist. Nat. des Insect. Apt. t. iv. p. 513.

In December 1837 I obtained males and females of this spider under stones on Gallt y Rhyg, a mountain in the vicinity of Llanrwst; and in 1841 Miss Ellen Clayton favoured me with specimens taken at Ingleton in Yorkshire.

155. *Neriëne sulcata.*

Neriëne sulcata, Blackw. Annals and Mag. of Nat. Hist. vol. xiii. p. 184.

My son, John Blackwall, discovered an adult male of this species, which is nearly allied to the spiders constituting the genus *Walckenaëra,* on the steps at Oakland in June 1841.

156. *Neriëne abnormis.*

Neriëne abnormis, Blackw. Linn. Trans. vol. xviii. p. 649.
Argus abnormis, Walck. Hist. Nat. des Insect. Apt. t. iv. p. 512.

By the structure of its oral apparatus and by the disposition and relative size of its eyes, this spider makes a near approximation to the *Linyphiæ.* It was taken under stones at Crumpsall Hall in October 1836.

157. *Neriëne rubripes.*

Neriëne rubripes, Blackw. Lond. and Edinb. Phil. Mag. Third Series, vol. viii. p. 485.

My brother, Mr. Thomas Blackwall, found this species under stones at Oakland in the autumn of 1834.

158. *Neriëne dubia.*

Neriëne dubia, Blackw. Linn. Trans. vol. xviii. p. 652.
Argus dubius, Walck. Hist. Nat. des Insect. Apt. t. iv. p. 513.

The male of *Neriëne dubia,* which has much resemblance to the *Theridia* in external structure, was captured on iron rails at Crumpsall Hall in October 1836. I have placed it, provisionally, in the genus *Neriëne,* till the female shall be discovered, as the sexes of the same spider frequently differ in the relative length of the legs and in the form of the maxillæ.

Genus Walckenaëra, Blackw.

159. *Walckenaëra acuminata.*

Walckenaëra acuminata, Blackw. Lond. and Edinb. Phil. Mag. Third Series, vol. iii. p. 106 ; Research. in Zool. p. 315. pl. 2. fig. 3–6.
Micryphantes camelinus, Koch, Die Arachn. B. iii. p. 11. tab. 76. fig. 168, 169.

Both sexes of this curiously constructed spider were taken by Mr. Thomas Blackwall in October 1832 under stones and on rails in the township of Crumpsall. I have since met with it in Denbighshire, and in the spring of 1849 I received specimens of the female from Mr. J. Hardy, who took them in Berwickshire.

In autumn the female deposits between 20 and 30 spherical eggs of a yellow colour, not agglutinated together, in a plano-convex cocoon composed of fine white silk of a looseish texture, measuring $\frac{5}{16}$ths of an inch in diameter; it is attached by the plane surface to the under side of stones and fragments of rock, and its form is frequently modified by irregularities on the surface of the body to which it adheres.

M. Walckenaer entertains the opinion that his *Argus cornutus*

(Hist. Nat. des Insect. Apt. t. ii. p. 367), and the *Theridion cornutum* of M. Wider (Museum Senckenbergianum, B. i. p. 235. taf. 16. fig. 2) are the same as the *Micryphantes camelinus* of M. Koch, which is identical with *Walckenaëra acuminata*; but they differ from it, apparently, both in structure and colour; and I have already shown (Annals and Mag. of Nat. Hist. Second Series, vol. ix. p. 17) that the *Linyphia alticeps* of Prof. Sundevall, included by M. Walckenaer among the synonyma of this species, is perfectly distinct from it.

160. *Walckenaëra cuspidata.*

Walckenaëra cuspidata, Blackw. Lond. and Edinb. Phil. Mag. Third Series, vol. iii. p. 108; Research. in Zool. p. 320. pl. 2. fig. 11.

This rare spider is found under stones and on rails in the south of Lancashire, in Yorkshire, and in Denbighshire, and two females, one adult and the other immature, were transmitted to me from Berwickshire by Mr. J. Hardy in the spring of 1849.

The *Theridion monoceros* of M. Wider is nearly allied to this species, but it presents several points of difference both in structure and colour (Museum Senckenbergianum, B. i. p. 236. taf. 16. fig. 3).

161. *Walckenaëra Hardii.*

Walckenaëra Hardii, Blackw. Annals and Mag. Nat. Hist. Second Series, vol. vi. p. 340.

I am indebted to Mr. J. Hardy for an adult male of this species, which was sent to me from Berwickshire with other specimens of *Araneidea* in December 1848. It is nearly allied to *Walckenaëra cuspidata*.

162. *Walckenaëra obtusa.*

Walckenaëra obtusa, Blackw. Lond. and Edinb. Phil. Mag. Third Series, vol. viii. p. 482.

A few males of *Walckenaëra obtusa*, in a state of maturity, were discovered under stones at Oakland in February 1835. Between the male of this species and the male of *Walckenaëra cuspidata* there is a striking resemblance; but the smaller size of the latter, the comparative shortness of its sternum, differences in the structure of its palpi, and especially the acute conical prominence situated within the trapezoid formed by the four intermediate eyes, effectually serve to distinguish it from the former.

163. *Walckenaëra fuscipes.*

Walckenaëra fuscipes, Blackw. Lond. and Edinb. Phil. Mag. Third Series, vol. viii. p. 481.

Adult males of this species were found under stones at Oakland in March 1835.

164. *Walckenaëra punctata.*

Walckenaëra punctata, Blackw. Linn. Trans. vol. xviii. p. 629.
Argus trapezoïdes, Walck. Hist. Nat. des Insect. Apt. t. iv. p. 503.

M. Walckenaer, in disposing of *Walckenaëra punctata* as a synonym of *Argus trapezoïdes,* refers to his 'Hist. Nat. des Insect. Apt.' t. ii. p. 353 for an account of the latter; but as no species bearing that name is included in the volume, I am unable to dispel the obscurity in which the subject is involved.

Females of this spider were taken in May 1838 under stones in a moist pasture near Llanrwst.

165. *Walckenaëra obscura.*

Walckenaëra obscura, Blackw. Research. in Zool. p. 321.

Several males of this species, having the palpal organs fully developed, were obtained on iron rails at Crumpsall Hall in April 1834, and on plants growing in the woods at Oakland early in June 1835.

166. *Walckenaëra flavipes.*

Walckenaëra flavipes, Blackw. Research. in Zool. p. 322.

In May 1834 I captured an adult male *Walckenaëra flavipes* under the exfoliating bark of a sycamore at Crumpsall Hall, and in the spring of 1840 I met with both sexes under stones imbedded in the earth in a pasture at Oakland.

167. *Walckenaëra turgida.*

Walckenaëra turgida, Blackw. Linn. Trans. vol. xviii. p. 630.

Specimens of this spider were discovered in the autumn of 1836 under stones and blocks of wood in the plantations at Crumpsall Hall.

A suspicion is expressed by M. Walckenaer that *Walckenaëra turgida* may be identical with *Argus parallelus* (Hist. Nat. des Insect. Apt. t. iv. p. 508); but the males of these species exhibit differences in the form of the anterior part of the cephalo-thorax and in the disposition of the eyes.

168. *Walckenaëra atra.*

Walckenaëra atra, Blackw. Linn. Trans. vol. xviii. p. 631.
Argus ater, Walck. Hist. Nat. des Insect. Apt. t. iv. p. 508.

Both sexes of *Walckenaëra atra,* the males having the palpal organs in a perfect state of development, were found in May 1838 under stones in a moist pasture near Llanrwst.

In the 'Transactions of the Linnæan Society,' vol. xviii. p. 632,

a conjecture is advanced that this species may be the same as the *Theridion acuminatum* of M. Wider (Museum Senckenbergianum, B. i. p. 232. taf. 15. fig. 11); but well-marked differences in size, structure, and colour plainly show that they are distinct; and a comparison made between *Walckenaëra atra* and *Argus bicuspidatus*, as suggested by M. Walckenaer in his 'Hist. Nat. des Insect. Apt.' t. iv. p. 508, has been attended with a similar result.

XXIII.—*Brief Diagnostic Notices of new Maderan Land Shells.* By the Rev. R. T. Lowe, M.A.

[Concluded from p. 120.]

Pupa, Drap.

§. *Paludinella*, Lowe.

50. Pupa limnæana.—*P. edentulæ*, Drap., proxima. Differt testa distincte umbilicata arcte substriata, apertura oblique ovali longiore quam lata, $\frac{2}{5}$ longitudinis æquante. *Limnæo minuto*, Drap., simillima, *Bulimum ventrosum*, Fér., quoque refert.
Hab. in Madera.

51. Pupa microspora. Differt a *P. limnæana* testa vix subperforata plusquam dimidio minore minuta conico-ovata nec ventricosa, apertura transverse ovali depressa latiore quam longa, $\frac{1}{3}$ longitudinis æquante.
Hab. in Madera. Coll. Wollaston.

§. *Truncatellina*, Lowe.

52. Pupa linearis.—*P. minutissimæ*, Hartm. (*Vertigini cylindricæ*, Fér.) nimis forsan affinis. Differre videtur anfractuum numero (6–7), et peristomate simplici acuto; sed ab defectu exemplorum testæ Europææ, comparationem magis exactam instituere nequeo.
Hab. semifossilis in Madera.

§. *Gastrodon*, Lowe.

53. Pupa fanalensis.—*P. anconostomati*, Lowe, affinis. Differt forma breviore obesiore ovatiore basi sublatiore, anfractibus convexioribus, sutura impressa, apertura basi rotundata nec angulata, plica ventrali validiore, carinaque umbilicali obsoleta. Testa quoque minor subfasciata habitu peculiari proprio.
Hab. in Madera. Coll. Wollaston et Lowe.

§. *Leiostyla*, Lowe.

54. Pupa vincta.—Differt a *P. cheilogona*, Lowe, magnitudine minore, forma breviore obesiore, apice obtusiore, apertura rotundato-ovali nec auriformi, testa læviore nitidiore lætius colorata s. fasciata, plicis ventralibus majoribus, &c. *P. irriguæ* proxima, sed revera distincta.

Hab. in Madera. Coll. Wollaston et Lowe.

55. Pupa irrigua.—Differt a *P. cheilogona* et *vincta*, Lowe, præter alia, apertura ringente confertim multiplicosa; a *P. sphinctostomate*, Lowe, magnitudine majore, forma magis ovata obesiore, testa læviore nitidiore, labroque intus plica distincta tantum unica.

Hab. in Madera. Coll. Wollaston et Lowe.

56. Pupa laurinea.—Differt a *P. sphinctostomate a*, Lowe, testa omnino læviore nitidiore intensius colorata sc. fulvo-cornea olivaceo-nigrescente nec pallide flavo-cornea; forma plerumque curta obesa, in exemplaribus porro magis cylindricis quoad longitudinem minus gracili latiore; apertura ad denticulum constrictiuscula haud ringente, plicis paucioribus (4–5), omnibus præter ventralem externam magis immersis remotisque, ventrali interna columellari semper unicæ æquali, subinconspicuis parvis; sinu respiratorio subapertiore; peristomate incrassato ad denticulum indentato-sinuato plicisque plus minus coloratis.

Hab. in Madera, arborea in truncis Laurorum.

Obs. In *P. sphinctostomate*, speciem proprie rupestrem, raro arboream, quasi transit; sed habitu aspectuque proprio, necnon habitatione semper inter muscos in truncis Laurorum sylvicola fere discernenda.

57. Pupa lævigata.—*P. sphinctostomati* proxima. Differt apertura subeffusa patula, nec ringente nec coarctato-plicata, plicis tantum 4 remotis, columellari palatalique unica. Ab hac æque ac a *P. laurinea* et *P. recta* differt forma ab anfractu penultimo usque ad apicem sensim subattenuata.

Hab. in Madera. Coll. Wollaston.

58. Pupa recta.—Differt a *P. sphinctostomate* et *P. lævigata*, Lowe, testa majore elongato-cylindrica minus nitente sericeo-lævigata spadiceo-fusca distinctius fasciata, apertura haud ringente, plicis 5–6 remotis, 2 ventralibus, 1–2 columellaribus (superiore obsoleta), 2 palatalibus; labro æquali, denticulo obsoletissimo.

Hab. in Madera.

59. Pupa macilenta.—*P. rectæ* nimis forsan propinqua. Differt testa minore distinctius striata, plicis tribus internis

æqualibus, ventrali interiore columellarique majoribus magisque prominentibus.

Hab. in Deserta Majore. Coll. Wollaston.

§. *Craticula*, Lowe.

(*Orcula*, Held ?)

60. Pupa fusca.—Differt a *P. macilenta* testa distinctius crebristriata absque nitore, apertura sex-plicata, plicis confertis subimmersis, anfractibus convexis, sutura impressa.

Hab. in Madera.

61. Pupa millegrana.—*Pupæ fuscæ* simillima, sed multo minor, anfractibus paucioribus, striis validioribus subremotioribus, apertura septemplicata, plicis tubercularibus oppositis (nec conferruminatis) constricta.

Hab. in Madera; etiam in Deserta Majore, Wollaston.

62. Pupa ferraria.—A *P. fusca* striis remotioribus validioribus, plicis lamellatis nec tuberculatis magis inconspicuis; a *P. monticola*, Lowe (Prim. 63. t. 6. f. 33) testa majore graciliore elongatiore, striis confertis tenuioribus, plicis magis inconspicuis, differt.

Hab. in Portu S^to^. Inv. Wollaston.

§. *Alvearella*, Lowe.

63. Pupa cassidula.—*P. cassidæ*, Lowe (Prim. 64. t. 6. f. 35), quodammodo affinis; illa vero sectionem peculiarem propriam, *Scarabellam*, Lowe, constituit. *P. cassidula* magnitudine habituque necnon umbilico largo patulo spirali toto cœlo differt. Apertura 7-plicata ringens.

Hab. in Madera. Inv. Wollaston.

64. Pupa concinna.—*Pupæ cassidulæ* affinis, *P. laurineæ* forsan propior; ab illa apertura haud ringente quinqueplicata, ab hac striis distinctis capillaribus, plicis tribus internis magis prominentibus conspicuis, duobus ventralibus obliquioribus nec verticalibus differt.

Hab. in Madera, Wollaston et Lowe.

65. Pupa abbreviata.—Differt a *P. concinna* testa fere dimidio minore, striis validioribus, plicis magis inconspicuis minoribus.

Hab. semifossilis in Madera.

66. Pupa gibba.—Species distinctissima, pulcherrima, rarissima, ab omnibus differt anfractibus costis remotiusculis æqui-

distantibus transversis, interstitiis exilissime spiraliter striatis, apertura ringente subtrifoliato-lobata, plicis magnis prominentibus, forma valde curta abbreviata.

Hab. in Madera. Inv. Wollaston.

§. *Mastula,* Lowe.

67. Pupa lamellosa.—Testa abbreviato-cylindrica turbinata mammiformis tenuis, anfractibus tumido-convexis, oblique et remote lamellato-costatis, lamellis membranaceis in medio anfractuum dilatatis sæpe lacero-dentatis s. subaculeatis, apertura depressa triplicata. *H. aculeatam,* Müll., refert.

Hab. in Madera. Inv. Wollaston.

§. *Staurodon,* Lowe.

68. Pupa saxicola.—*P.* (*Vertigini*) *alpestri* (Fér.), Gray, Man. p. 202. t. 12. f. 141. affinis. Differt testa minore fusco-cornea subopaca solidiuscula, apertura (4-plicata) dente tuberculari ad angulum labri ante plicam ventralem adjecto, peristomate æquali continuo, labro nec sinuato nec inflexo, marginibus callo in ventrem incrassato relevato junctis. A *P. pygmæa,* Drap., testa minore subcylindrica minus nitente striolata, plicis aperturæ majoribus 4 exacte cruciatis, dente tuberculari ante ventralem adjecto, peristomate simplici incrassato obtuso nec varicoso, marginibus callo relevato junctis satis superque distincta videtur.

Hab. in Madera; Leacock, Wollaston.

69. Pupa seminulum.—Differt a *P. saxicola* testa minore etiam minutissima, anfractibus magis tumidis convexis, sutura profundiore, forma subobesiore, apice obtusiore apertura subtriplicata, plicis in triangulum dispositis inæqualibus, ventrali majore, columellari palatalique minoribus subæqualibus, labro subangulari rectiusculo inflexo-sinuato, denticulo superne intus distinctiusculo.

Hab. in Madera. Inv. T. S. Leacock.

Clausilia, Drap.

Clausiliæ speciem nullam Maderensem novam, præter tres in Primitiis jam memoratas, inveni. Speciem vero elegantissimam a Lusitania nuperrime ab amico Lourenço José Moniz, M.D. Consiliario Regio, Historiæ Naturalis indagatore peritissimo benevole communicatam, hic adjungere licet.

Clausilia Moniziana.

C. testa subrimata gracillima angusta turrito-elongata subaciculari tenuiuscula, apice lævi mammillari truncato-rotundata; anfractibus 14–15 tenuistriatis planatis, sutura parum impressa

simplici (nec crenata), striis minutissime subcrenatis v. subcrispulis; anfractu ultimo basi sulcato obtuse bicristato; apertura oblique ovato-pyriformis subrhomboidea, lamella supera tenui distincta, infera crassiore magis immersa antice dilatato-obsoleta, lunella nulla v. inconspicua; plicis palatalibus duabus tuberculiformibus, supera (subcolumellari) inconspicua subimmersa, infera distinctiore subprominula alba; peristomate continuo soluto expanso albo-limbato.

Long. 13–14, lat. $2\frac{1}{2}$, long. apert. $2\frac{2}{3}$–$2\frac{3}{4}$ mill.

Hab. prope Lisbon, L. J. Moniz.

Differt a *C. rugosa* (Drap.), Pf. Mon. ii. 475, testa graciliore angustiore apice distincte mamillata, lunella nulla v. inconspicua, &c. An "*C. rugosa,* Morelet, Moll. du Port. p. 75," Pf. l. c. eadem?

CYCLOSTOMA, Lam.

§. *Hygrobium,* Lowe.

70. CYCLOSTOMA LYONNETIANUM.—Differt a *C. lucido,* Lowe, testa multo minore elevato-trochoidea exilissime spiraliter striata, anfractu ultimo carinato-angulato. *Gibbum Lyonnetianum,* Pall., forma quodammodo refert.

Hab. in Madera. Inv. Wollaston.

Madera, Dec. 1851.

XXIV.—*On the Gangetic Dolphin.* By DAN. FRED. ESCHRICHT, Professor at the University of Copenhagen. Being a Supplement to his Memoirs on Whales. Transactions of the Royal Danish Academy of Sciences, 5th Series, vol. ii. (separately printed, Copenhagen, 1851, 4to.) Translated from the Danish by Dr. WALLICH, F.R.S., Vice-Pres. Linn. Soc.

[Concluded from p. 188.]

ZOOLOGISTS have agreed, since the time of Cuvier, that the proper place of a vertebrate animal in the system is perhaps most safely decided by the structure of its skeleton; and if this rule holds good as to the class generally, it probably applies still more forcibly to Cetacea than to any order, because here, under the determinate outer form of a fish, we have concealed the perfect structure of a mammal, in which another further difference manifests itself, which has hitherto been rated on too low a scale. Of the correctness of this assertion, the skeleton of the Gangetic dolphin affords the best proof. Lebeck and Roxburgh had already shown the striking discrepancies in the form of its beak, its breast-fins and spiracle; but it was only after Cuvier had described

the skeleton, that, as has already been observed above, we became aware of the structure being the most peculiar in the whole group of Dolphins—one which "deserved above all others to constitute a distinct genus." The large advancement which cetology made in the time of Cuvier, and mostly by his aid alone, will at once be acknowledged by comparing his first labours and researches in that direction, with his latest works, published after his death. It was indeed so great, that cetology has not been equally advanced since that period, by the various publications of other authors. And yet Cuvier had not been able to collect a sufficiency of whale-skeletons to enable him to settle the Linnæan genus *Delphinus*, according to the greater or less affinity of the already then very numerous species; but was obliged to content himself with the suggestion, which we have just quoted, that the Gangetic dolphin, perhaps more than any other dolphin, deserved to constitute a peculiar genus; without, however, assigning to it any place in the series of toothed whales. Schlegel* placed it nearest the large and more robust, proper dolphins, which he called *die Tümmler*, and of which *D. Tursio* was the type. J. E. Gray† placed it, somewhat more successfully, nearest to the *Inia boliviensis*, described by Alcide d'Orbigny‡, which inhabits one of the mountain branches of the Amazon, 700 French leagues from the sea. Perhaps A. Wagner§ was equally successful in placing it between the Tooth-whale of the Amazon and the Micropteron. They have certainly been far nearer the mark than I was in my arrangement of Cetacea according to their food, in putting it as the extreme limit of toothed whales, while the Hyperoodons and the Cachalot were made to occupy the contrary extreme‖. All who have followed me in the preceding description of the skeleton of the Gangetic dolphin, will no doubt arrive at the same conclusion, especially if reference is also had to my antecedent account of the Hyperoodon proper (Döglingen¶) and of *Rhynchoceti* generally**. I now proceed to explain, that our dolphin approaches in most respects nearest to the Hyperoodons, though

* Abhandlungen aus dem Gebiete der Zoologie und vergleichenden Anatomie. 1 Heft. Leyden, 1841, 4to, p. 28.

† Voyage of the Erebus and Terror.

‡ Notice sur un nouveau genre de Cétace. Nouvelles Annales du Muséum d'Hist. Nat. tome iii. p. 22. pl. 3. Paris, 1834.

§ Die Säugthiere in Abbildungen nach der Natur, mit Beschreibungen, von J. C. D. Schreber, fortgesetzt von Joh. Andr. Wagner. 7 Theil. Erlangen, 1846.

‖ Zoologisch-anatomisch-physiologische Untersuchungen über die nordischen Wallthiere, p. 7. Leipz. 1849, 4to.

¶ Fourth Memoir on Whales, in Transact. of the Royal Danish Acad. of Sciences, Sect. Nat. Hist. and Mathemat., vol. ii. 1845.

** Sixth Memoir on Whales, *l. c.* 5th series, vol. i. 1849.

in some it comes close to the whitefish and the allied great tooth-whales, in others to the dolphin of the Amazon; while again in some respects it stands quite isolated.

The most striking peculiarity in its cranium is manifestly the two vaulted osseous crests on the upper jaw. These not only resemble the crests of the Hyperoodon, but are essentially of the same form; the only difference consisting in their being more vaulted in the Gangetic dolphin, and having in consequence a greater space between them; but they rise similarly from the side of each upper jaw-bone, and approach more closely together along the middle, by age. This has been pointed out by Mr. Gray, as regards our dolphin; and in my memoir last quoted (p. 98), I have thrôwn out a hint, that something very similar takes place in the Hyperoodon: "Mr. Gray's *Hyperoodon latifrons* is a good species, founded on a cranium from the Orkney Islands with the crests on the upper jaw unusually thick; and yet it may perhaps be only the cranium of an old male of the common Hyperoodon." This supposition has since become a matter of certainty; for all crania of old Hyperoodons, at least of males, have the crests similarly developed, as has actually been verified in a skeleton of an old individual of this kind, sent to my worthy colleague Prof. Steenstrup from the Feroë Islands, and by him kindly transferred to the zootomic-physiologic museum of our University, under my charge. It is therefore fully proved, in my opinion, that, while on the one hand this specific formation can no longer be considered as characterizing singly the species hitherto founded on it; so, on the other, does it establish the similarity, in that respect, between our dolphin and the Hyperoodon proper. It is, further, very striking, that in consequence of that formation, the Gangetic dolphin is more nearly allied to the Hyperoodon than to the Micropteron, or any other fossil cetacean belonging to the group of the former (*Ziphius*).

I have endeavoured to point out another, scarcely less characteristic, formation of the cranium in our dolphin, as regards the palate, which in my view is principally formed of the pterygoid bones, extending entirely over (in the proper position of the animal, under) the palatal bones. Something approaching to this reappears in the Hyperoodons. In all other whales the pterygoid bones only occupy the posterior part of the palate. This similarity would be still greater, were it not that I have shown, that in the Hyperoodons the palatal bones extend to the outermost part of the palate, and that the lacrymal bone is present, which is wanting in the Gangetic dolphin, as well as generally in all toothed whales, owing probably to the peculiar circumstance of the confined extent of the orbits (see Memoirs quoted before, pp. 375 and 93 respectively). A further confor-

mity in the crania reappears in the connexion of the pars petrosa with the bulla tympani, and still more its protrusion into the walls of the skull and peculiar connexion with the temporal bone. But here a still greater similarity presents itself with the Cachalot, which is far more closely allied to the Hyperoodons, than any other Linnæan dolphins. In the form of the under jaw it is more like the Cachalot; while in that of the upper jaw, it resembles most the Hyperoodon. Its great supply of teeth must have appeared a strong objection to earlier observers, to consider it as nearly allied to the Hyperoodon and Cachalot, in the former of which the teeth exist only in the most anterior part of the under jaw, and in the latter they are confined entirely to the lower jaw. This objection, however, has lost the greatest part of its force, for I have succeeded in proving, that there exists a complete series of teeth in both jaws of the Hyperoodon, though they never attain their full development (*l. c.* pp. 375 and 337). There is, at least, this similarity of teeth between the Hyperoodon and our dolphin, that the foremost are by far the most developed, which is not the case in any of the dolphins proper; and between it and the Cachalot, and the Hyperoodons generally, that they are most developed in the under jaw, though comparatively in a very slight degree here. This undeniable analogy in the structure of the cranium, with the Hyperoodons, and partly the Cachalot, which is not far removed from these, is altogether lost almost, as regards the rest of the skeleton.

In the skeleton of the Hyperoodon we have the following striking peculiarities:—1. a most unusually low number of ribs (9 pairs for 55 vertebræ); the thorax close up to the heavy head; all the seven vertebræ of the neck grown together into one mass of bone; 2. the strikingly extended lumbar region, as compared to the neck and thorax, considerably longer than both these together, and almost as long as the tail; and, 3. the not less strikingly high and bulky spinous processes. On the contrary, in the Gangetic dolphin we see—1. a very usual number of ribs (11 pairs to 51 vertebræ); the thorax removed to an unusually great distance (for the order of whales) from the head, owing to the length of the neck (only $11\frac{1}{2}$ times shorter than the entire vertebral column, in the Hyperoodon about 28 times), and the cervical vertebræ being, besides, strongly developed, and moveable among themselves; 2. the lumbar region only somewhat more than double the length of the neck ($\frac{46}{107}$), exactly the length only of the thorax, and only about $\frac{2}{5}$ ($\frac{107}{269}$) of the tail; and finally, 3. the spinous processes short, not only in comparison with the Hyperoodons, but generally with dolphins proper. All these discrepancies indicate a great diversity in the mode of living of the Gangetic dolphin and the Hyperoodon. The skeleton of the last

points it out as a strong swimmer, the spinous as well as transverse processes serving, even in the lumbar region, for the insertion of the muscles of the tail, by which the body is propelled through the water; and the short and unbending tail is an essential condition for securing to the head and the whole body with it, a ready propulsion through the waves of the sea. The Gangetic dolphin, on the contrary, is distinguished as a cetaceous animal, by having a limited power of swimming, combined with a certain degree of motion of the head and its long and pointed beak. If we desire to trace these peculiarities of the *Platanista* skeleton among other groups of whales, we shall soon and easily recognise them in the Whitefish and the nearly allied Narwhale; the former having fifty-one vertebræ (the latter fifty-two), with eleven pairs of ribs (in the latter there is an imperfect twelfth pair); the Narwhales having a proportionally long neck; and their cervical vertebræ (at least in the Whitefish) being never anchylosed, but always connected by means of joints *. There is another remarkable circumstance, namely, that the processus odontoideus in the Whitefish is, next after our dolphin, more clearly developed than in any other member of the order; it has however the same form, the obliquely truncated articulating surface, directed rather towards the head than to the ventral surface, as in the Gangetic dolphin. Not only in regard to the neck, but also in other regions of the skeleton, is our dolphin nearest allied to the Whitefish. Its vertebræ are much fewer in number (fifty-one) than in the proper dolphins generally (the long-jawed, many-toothed); greater than in the Hyperoodons and even in the small Finwhales, equalling exactly the number in the Whitefish (the Narwhale having an additional pair of vertebræ). The pairs of ribs (eleven) are more numerous than in the Hyperoodon, but precisely as in the Whitefish (the Narwhale having usually a twelfth pair, though it is disproportionally short). Of far greater importance is the similarity in the form of the vertebræ, which, in the Hyperoodon, as in the proper Dolphins, are distinguished by the remarkably high spinous processes, particularly in the thoracic vertebræ, while in our dolphin they are low,

* This is what I have seen in all the Whitefish skeletons examined by me; and as far as I know, no one else has found it otherwise. Occasionally a pair of the foremost cervical vertebræ are found connate in the Narwhale; in the *Vaagehval* sometimes the second with the first or third. But these varying ossifications belong by no means exclusively to old skeletons; and they cannot therefore serve as an argument in favour of the entirely unfounded assumption, at least as a general one, that growing together of the cervical vertebræ in whales, is the effect of age. I shall be able to prove in a future Memoir on Whales (the seventh in the series), as the result of long-continued inquiries, that the normal combination of these vertebræ, already shows itself, in most species of whales, while still in the state of cartilage.

as in the Whitefish and Hyperoodon. Finally, the short, broad, shawl-formed breast-fins approach perhaps nearest those of the Whitefish and the Narwhale.

The bony structure of the Gangetic dolphin approaches, then, as regards the head nearest to the Hyperoodons, in regard to the rest of the skeleton nearest to the Whitefish. It now only remains to determine the *similarity or dissimilarity of its outer forms, as compared with other Cetacea.* From what has been said in the first part of this memoir, respecting the published figures, it is obvious, that we cannot be said to have possessed hitherto a faithful and clear representation of the Gangetic dolphin; and in this view M. Reinhardt's scientific claims are deservedly as great, as his merits in osteological respects, by having prepared and preserved so perfect a skeleton of the Gangetic dolphin as to meet all the demands of the science. The figure executed by M. Thornam, under his direction, from the recently caught animal, has been rendered with great fidelity in Pl. V. fig. 1. I will here give M. Reinhardt's own measurements and notes as part of the external description of the animal:—

"Total length	5′	2″	0‴
Length from end of snout to the eye	1	0	6
Length from end of snout to the ear	1	3	6
Length from end of snout to anterior angle of base of the fin	3	0	0
Length of the rostrum of upper jaw	0	8	6
Expanded wings of tail	1	3	0
Round the body over the sexual organ	2	11	0

"The eye extraordinarily small; in diameter only $1\frac{1}{2}'''$. The ear situated inconsiderably above the eye. The spiracle a simple longitudinal fissure, measuring $1''\ 9\frac{1}{2}'''$; its anterior end exactly in a vertical line above the eye. Female sexual organ about 2″ long, showing nothing remarkable in its form, nor in the furrows, in which the papillæ are situated. The tongue exceedingly short, adnate in its whole circumference, and reaching only as far as the point, where the upper jaw contracts itself into the narrow rostrum. The body enveloped in a thick layer of fat, measuring $1\frac{1}{2}''$ where thickest. Colour on the back dark lead-gray; under the belly somewhat lighter, though not much. This was the appearance for a short time only after the animal had been taken out of the water; after the epidermis had dried, the colour became lighter throughout."

The peculiarly favourable opportunity, the skill of the draftsman, but above all the great experience of the naturalist, sufficiently guarantee the correctness of the representation and its accompanying description; but the exactness of the drawing is still further corroborated by the close correspondence of its pro-

portions with the skeleton of the self-same individual (Pl.V. fig.2): a skeleton prepared and preserved with such extreme care, that not only do the several bones still continue their natural connexion, but the external skin remains adhering to the extremity of the tail and the ends of the fingers, proving to demonstration, not only that not one single caudal vertebra, or joint of the fingers, is defective, but even the four wavy prominences of the posterior margin of the breast-fins, corresponding to the four larger finger ends, may still be easily recognized. Only on one point I confess, that I entertain some doubt as to the exactness of the drawing; namely the position of the eye and ear, which, to judge from the skeleton, appear rather too high above the angle of the mouth; it being manifest that the eye must come exactly under the processus orbitalis of the frontal bone, which in the profile representation of the skeleton (Pl. V. fig. 2) is seen by no means so high up. Experience proves that mistakes of this kind are very easily made, when minute parts of large convex objects are to be represented. In order to express such minute parts, the painter draws nearer the object, and the requisite perspective proportions are easily lost. Therefore, although convinced of the existence of the mistake just mentioned, which was so easy of correction, I have deemed it my duty not to deviate in respect to it, but to give a faithful counterpart of the original drawing. If we now compare this drawing of M. Thornam's taken from the recent animal, with the earlier ones, cited above, and keep in view the reasons assigned for its correctness, the less favourable report I have given of even the more recent representations must be assented to. Among the older ones, Lebeck's figure, however rude, gives this animal the prevailing straight cylindrical form of all whales, tapering before and behind, without curvature in the back (as in Roxburgh's and F. Cuvier's), much less in the neck and tail parts (as in Gray's); the skin stretched tightly over the whole body without depression over the neck (as in Gray's); the breast-fins quite stiff and the fingers immoveable among themselves (therefore not capable of being folded together like a fan, which the drawings of Roxburgh, Cuvier, and Gray seem to indicate). M. Reinhardt has caused a separate outline to be taken from above (Pl. V. fig. 4). He says the blow-hole is a perfectly straight longitudinal slit, without the faint double curve of an S, attributed to it by Lebeck and Roxburgh; and is represented by him alone as quite shut (fig. 3), which it is self-evident it must be, except during the moment of respiration.

Of the greatest importance is the perfect confirmation, by M. Reinhardt's own observation and skeleton, of Roxburgh's original assertion, concerning the extreme smallness of the eyes of the Gangetic dolphin: "Eyes exceedingly minute, being only a line

in diameter, and sunk pretty deep in their small round orbits;" the whole length of his specimen being $6\frac{1}{2}$ English feet. That this remark, made simultaneously with the announcement of the existence of such an animal, scarcely should have received any notice, might be excused perhaps by its not being corroborated in Roxburgh's own figure; but not so after Cuvier had completely verified the remark in his researches on the cranium, especially with regard to the corresponding smallness of the orbita and the consequent abbreviation in the stem of the zygomatic bone, which is quite unknown among any other toothed whales. Notwithstanding all this, the minute size of the eye in the Gangetic dolphin has escaped attention to such a degree, that even in the most modern figures (Gray's and Jardine's) it is represented large in comparison with other Cetacea. The materials furnished by M. Reinhardt give the fullest signification to this proportion, inasmuch as in Thornam's drawing the *physiognomy* of a *blind whale,* which by measurement belongs to our dolphin, has been for the first time completely expressed. And yet it may be easily shown, that even in this the eye is not rendered in its proper insignificance; for the reduction being in the proportion of $\frac{5}{6}$, the slit for the eye—only 1 to $1\frac{1}{2}'''$—should have been given $\frac{1}{6}$ or $\frac{1}{4}'''$, whereas it is made $\frac{1}{3}'''$.

Anatomical considerations I think indicate, that the physiognomy of our dolphin as a blind cetacean, is not in appearance only, but significant as corresponding to the physiognomy of the mole. The very minute eye of our animal has hitherto caused but little surprise, because the eyes of whales in general have been commonly considered as exceedingly small; and this has been demonstrated by examples among the colossal species, none of the lesser sorts being adduced. This frequently repeated assertion that whales have small eyes, is, in fact, nothing but the expression of a rule of general application; namely that the eye (as well as the ear and brain), with equal functional development, corresponds only in a very slight degree to the size of the body; but that in by far the greatest majority of species of the same class—and still more in the same order and family—it is limited within the bounds of a certain absolute magnitude. This general rule properly applied,—and in a physiological sense the rule admits of very easy solution,—it can hardly be said that whales have particularly small eyes, as compared with mammalia in general. Among the smaller dolphins, with a circumference of body less than in man, for example in the porpoise, the diameter of the eye is about $1''$; and it is quite consonant with this, that colossal whales should have eyes only four times larger. In comparison with land-mammalia, the eye of whales cannot therefore be said to be absolutely small; but only in so far, that

the cornea—consequently a part of it not immediately connected with sight—occupies an unusual extent of its circumference (above one half in the greatest whales). But in comparison with other marine mammalia, namely Seals, the eye of whales must be called small, absolutely; because in those the eye is very large. It must accordingly be admitted as a proportionally significant feature in physiological respects, to meet with a toothed whale, not by any means of the small kinds, having an eye in diameter not more than $1\frac{1}{2}'''$. Assuming—for as yet we can do no more—that this little eye is constructed like that of Cetacea in general, consequently with an extraordinarily thick cornea, it must actually be ranked among the smallest in the class of Mammalia; and taking further into account its relative measurement, which is of less, but still of some weight on this occasion, the eye, like that of the mole, decidedly points out that the usual abode of the animal is void of solar light; in which respect, my statement of the smallness of the holes for the optic nerves, and the presumed extreme smallness, or almost rudimentary state of the optic nerves themselves, must be considered as decisive.

Our dolphin occupies therefore, in anatomical respects, the same place among whales, as the mole does among animals of prey, and the subterranean rodentia among the order of Rodentia. It now remains to find out whether this result corresponds with our experience as to the mode of living of the animal. The few and scanty communications of Lebeck and Roxburgh are reiterated in the following manuscript notes of M. Reinhardt, with additional not unimportant observations made by himself and others. "According to Dr. Cantor, the *Platanista* makes its appearance in the Hoogly at Calcutta only in the cold season (corresponding to our autumn or winter); but he was unable to state with certainty, whether it migrated after leaving that neighbourhood, though he conjectured, and no doubt rightly, that it is more probable it seeks the ocean than the higher parts of the river. It swims singly or in pairs, not gregariously, and at the time it makes its appearance in the Hoogly, it is by no means of rare occurrence; it is frequently observed to show a small part of its body above the surface of the water, and then immediately to dive down again. The animal is, however, rarely caught, by entangling itself in fishing nets, and upon the whole it is very difficult to obtain one. Mr. M'Clelland gives an account of a singular manner in which two individuals were caught (Calcutta Journal of Natural History, 1841, i. p. 425); namely in consequence of blowing up the wreck of some ship which was obstructing the navigation of the Hoogly, the column of water raised at the moment of explosion threw upon the shore two dolphins, a male and a female, together with a large quantity of fish. The male

measured 5 feet (4′ 10″ Danish); the female was 8 inches shorter and more slender. In general, at the time the animal appears in the Hoogly, the full-grown females are pregnant. This however was not the case with the individual of which the drawing and skeleton were brought home, owing most probably to its not having attained its full growth (5′ 2″); although an individual, which had been caught a few days before and was given to the Asiatic Society, contained an embryo of 14 to 15 inches." [Very likely the specimen brought home by Prof. Behn, to which we alluded above (p. 168).] "The stomach," M. Reinhardt continues, "was filled with a quantity of small fish and shrimps; among which were recognized *Clupea Telara*, Hamilton, a species of *Pimelodes*, and the large species of *Palæmon* and *Penæus*, common in the Calcutta fish-market." Roxburgh says, "In the stomach were found only some grains of paddy (rice in the husk), a few minute fragments of shells, and many living active ascarides. Notwithstanding the contents of the stomach of this individual, there is no doubt of the animal being piscivorous." According to Lebeck, "There were many living *Ascarides*, L., more than an inch long, both in the mouth and stomach, and in the latter grains of nellu (rice)."

To determine whether the substances found in the stomach bear any relation to any particular depth of the mud in which the Gangetic dolphin penetrates for its food, requires that we should possess a nearer acquaintance with the localities of the fishes and crustacea which M. Reinhardt mentions, and of the species of corn named by the older observers. M. Reinhardt's notice of the specimens, thrown up by the explosion by gunpowder of a sunken vessel, obviously proves nothing as to their being found near the bottom of rivers; still it tends that way. But if it should turn out that the animal does not exist at any greater depth below the surface of the water than whales in general, no other explanation remains but to connect its confined vision with the yellow, turbid water of the river in contradistinction to the clearness of the sea water; and we are thence necessarily led to the conclusion, that, although the animal actually leaves the river Hoogly at the close of the cold season, and takes to the sea, the quality of water just mentioned must be considered as its principal element or home; and thus we recognize in its peculiarly formed eye a very marked instance of adaptation between animal organization and the surrounding nature. Looking at its long, many-toothed beak, we are naturally reminded of a similar structure in the Gharial of the Ganges; and this coincidence between these animals, otherwise so widely remote from each other, urges on us the question, how far does this peculiar structure depend upon the peculiar condition of the water? If we are disposed

to answer in the affirmative, we have a further instance of harmonious adaptation.

Resuming the comparison, founded on the skeleton, between the Gangetic dolphin and other toothed whales, it is above all manifest, that the similarity with the Whitefish and the allied Narwhale, in the osseous structure of their spinal column and breast-fins, reappears again in the outer form of the body, and not only in the breast-fins, but in the extremely low dorsal fins, making it very probable that a certain extent of coincidence also occurs in their mode of existence. I find the following observations on the Whitefish among the notes on the whales of the coast of Greenland, which Capt. Holböll has placed at my disposal. "The Whitefish supports itself both on fish and cuttlefish, as well as shell-fish, which it fetches from a very great depth. Remnants of these animals are commonly found in its stomach; but if absent, it is generally filled with clay, or more rarely with sand. I am at present unable to decide, whether it actually feeds on the rich clay, or only swallows it together with sand, for the purpose of digesting the animals which abound therein. Like the Hyperoodon, the Whitefish must have the power to get rid very quickly of its food on finding itself in danger. The chase after it in the 'Sound' is sometimes concluded in a few hours, and yet either nothing is found in the stomach, or else only some loose fish-bones (of *Hippoglossus pinguis* and *Sebastes norvegicus*) or some cuttlefish."

Among some notes of M. Motzfeldt of Julianehaab, a native Greenlander, communicated by Capt. Hoiböll, I find the following:—"The Whitefish consumes enormous quantities of *Sepia loligo, Gadus æglefinus,* and large prawns. Vast numbers of that cuttlefish are found at Ritenbenk in spring and autumn, and of the *Gadus* in spring. The prawns are most probably caught at a great depth in the ocean."

It appears to me, that these observations on the Whitefish by experienced men, contain more than one feature corresponding entirely with what we know of the habits of the Gangetic dolphin, as far as can be judged from what has been communicated about those habits; while the similarity in that respect between the *Delphinus globiceps* and the *Micropteron* is confined to the circumstance, that these animals too are not gregarious, but live mostly singly or in pairs. Their food is wholly different; the Hyperoodon, as well as Cachalot and *D. globiceps,* subsisting chiefly on cuttlefish. That they likewise consume fish, is what may be said perhaps of all whales—even the preying kinds, the genus *Orca*—with exception only of the *Glathvals.*

It now remains to compare our dolphin with a whale, to which, judging from its exterior appearance and locality, it must come

nearest of all, namely the Amazon dolphin, or D'Orbigny's genus *Inia* (alluded to above, p. 280), where we have quoted a work of Andr. Wagner, in which he proves satisfactorily that this remarkable animal was first mentioned by Desmarest, was next brought to Europe by Spix and Martius, and lastly that it was described by D'Orbigny. The similarity is not only indicated by its river habitation, but also in its exterior form, because like our animal the dorsal fin is very low, and the beak long and toothed. But as far as the last-mentioned naturalist's very incomplete account and figure enable us to judge, none whatever of the peculiarities in the cranium of the Gangetic dolphin are found in the Amazon species; the teeth are totally different; the eyes can scarcely be called small. If I consider Messrs. Gray and Wagner's placing the two animals together as plausible, it is done chiefly in the expectation, that further researches may discover points of agreement also in the internal parts.

Taking a retrospective view of the series of coincidences and discrepancies in the structure and mode of life of the Gangetic dolphin, as compared on the one hand with those of the Hyperoodons, on the other with the Whitefish, and lastly the Amazon dolphin,—keeping before us its absolute peculiarities, that is, its rudimentary eye and its blowhole in the shape of a longitudinal fissure—we have a variety of differences in form, strongly contrasting with the commonly admitted uniformity of structure and mode of living of Cetacea. If we try to place it among the toothed whales, we cannot hesitate to constitute it into a separate genus, *Platanista*, nearest between the Hyperoodons and the Whitefish, the former of which are again close to the Cachalot (all having the shape of the jaws and the tongue of our animal); while the Whitefish approaches closest to the Narwhale, and next to *Delphinus globiceps*; but on the other hand, it must probably not be removed far from the Amazon dolphin, though the two can hardly be placed under one common group (*Platanistina* of Gray). In my sixth Memoir on Whales, I have endeavoured to prove in detail, by means of a series of researches into the osseous structure of the Hyperoodon, as compared with the short-finned dolphins (*Micropteron*), and the extinct species of Cuvier's *Ziphius*, that these whales are closely allied among each other. I have since had opportunities still further to corroborate those observations, especially with reference to the so-called *Delphinus Sowerbyensis*, which I have insisted on was only the male *Micropteron*. The cranium of Sowerby's valuable specimen, deposited in the anatomical museum of the University of Oxford, was reported by Mr. Gray as no longer existing there, and therefore reference was had to a drawing formerly made of it, and of which he has given a copy. It was therefore a very gratifying

surprise to me, not only to be favoured with a communication from Prof. Acland, Curator of the museum, to the effect that the specimen was quite safe in his custody, but with a complete plaster-of-Paris cast of it, enabling me to verify the correctness of the statement in my memoir, founded only on the said figure. I described (p. 97) the Hyperoodons as a very isolated group of toothed whales, represented at the time only by two species, but at present by many more, the number of fossil species not only exceeding those of the existing (as 3 to 2), but constituting, moreover, a very considerable proportion of the known fossil whales. It was to be expected that the gap between this form of antediluvian remains and existing species would be gradually supplied by intermediate forms, and that these might be expected among fossil specimens. If I mistake not, I have succeeded in pointing out such a form among species at present existing; and that this transition is distinguished from the formation of all other whales, by an almost total blindness, cannot fail being recognized as a most remarkable circumstance. It is to be expected that further forms of transition will be discovered, between the group of Hyperoodons and other cetaceous groups, or new links between them and the Gangetic dolphin. Perhaps the dolphin of the Amazon may be looked upon as such. Our animal stands so isolated, that it is likely the genus which it forms will be enlarged hereafter by other species; and I must here again quote M. Reinhardt, to whose exertions are due almost all the materials on which my present memoir is founded:—"I must add, that Mr. Blyth, Curator of the Asiatic Society's Museum, told me, that he distinguished two species of *Platanista*; one of them common in the Indus, but rarely found in the Ganges; the other or common Gangetic species (as far as I understand him) entirely wanting in the Indus; and that they were characterized by the different length of the rostrate portion of the upper jaw. I am not aware that they have been described, nor do I know the names given them by Mr. Blyth."

It must be obvious that the above remark must have recurred to my mind in noticing the discrepancy between former observations and my own. I am not alluding here to the very strong difference in the outer form, which according to usage in cetology, might easily lead to the adoption of a new species—but only to Cuvier's account of the skeleton, as regards the form of the beak, and the number of vertebræ and fingers. It is, of course, free to every one to consider those discrepancies as founded upon specific distinctions, contrary to what I have declared to be my views; and to combine them with that just mentioned of Mr. Blyth; but it appears to me that any such attempt must rest on a very insecure basis, like so many others, which have converted cetology into a labyrinth, where it is extremely arduous to find

the right path, and which has caused the science to retrograde instead of advancing. May these hints prove a strong inducement to obtain fresh light, and fresh materials for investigation, from the Ganges, the Indus, and generally the large rivers of Asia; and also on account of the as yet imperfect state of our knowledge of the dolphin of the Amazon, from the rivers of America. Not less important would be the examination of the viscera, especially the stomach and intestinal canal, as well as the small eye, in order to ascertain, as regards the former, whether the conformity is greatest with the highly characteristic group of Hyperoodons (the many-folded stomach and deeply-celled intestine), or the Whitefish and other dolphins; and as regards the eye, whether a complete organization exists, and whether in that case it is in accordance with the known type of the eye in whales, or differs. Embryos would probably supply the required information, at least with respect to the intestinal canal.

EXPLANATION OF PLATES V. VI. VII.

Plate V.

Fig. 1. A young female Gangetic dolphin, taken from an individual measuring 62 inches, caught in a fishing-net below the Botanic Garden near Calcutta, on the night of the 2nd and 3rd of December 1845, and presented to the Galathea Expedition by Dr. Wallich; drawn by M. Christian Thornam, painter in natural history, under direction of M. Johannes Reinhardt, zoologist to the expedition; reduced five-sixths*.

Fig. 2. Skeleton of the same in its natural connexion, on a black ground, with the natural outline of the animal.

Plate VI.

Fig. 1. Cranium of the same seen from above.
Fig. 2. Jaws seen sideways.
Fig. 3. Cranium seen from behind.

Plate VII.

Fig. 1. Cranium seen from below.
Fig. 2. Cranium seen from before and a little below.
Fig. 3. Seven cervical vertebræ (1–7), and 9 thoracic (8–16) from above.
Fig. 4. The three hindmost cervical vertebræ, and the first thoracic, from below.

On the figures of the cranium are represented by—*b*, os bregmatis or parietale; *e*, (Pl. VII. fig. 2) os ethmoideum; *f*, os frontale; *g*, os tympanicum or bulla tympani; *i*, os intermaxillare; *k*, processus condyloideus ossis occipitalis; *m*, os maxillare; *n*, os nasi; *o*, os occipitale; *p*, palatal plate of the upper jaw nearest the middle line of the palate (Pl. VII. fig. 1), os palatinum; *t*, os temporum; *t'*, processus zygomaticus ossis temporum; *u*, os pterygoideum; *v*, (Pl. VII. fig. 2) os vomer; *x*, os maxillare inferius; *z*, os zygo-

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* The reader should bear in mind that all the figures accompanying this translation have been further reduced $\frac{4}{7}$ths.

maticum—but Pl. VI. fig. 3. a peculiar bone, perhaps os Wormianum; +, (Pl. VI. fig. 1) nostrils, (Pl. VI. fig. 2) foramen magnum ossis occipitalis.

On the vertebral column Pl. VII. fig. 3. and 4. are represented by— *a, a,* processus articulares anteriores; *b,* neck of the first rib; *c, c,* bodies of ribs; *m, m,* processus mammillares; *o, o,* lower transverse process of the sixth cervical vertebra; *p, p,* posterior articular processes; *q,* lower transverse process of the fifth cervical vertebra; *r,* single lower transverse process of the seventh cervical vertebra; *t,* upper or proper transverse processes; *x,* costal prominence on the upper transverse process of the sixth cervical vertebra.

All the figures on Plate VI. and VII. scarcely reduced ⅔rds.

ERRATUM.

At page 168, third line from bottom, *for* $3\frac{1}{6}$ feet *read* $5\frac{1}{6}$ feet.

XXV.—*Further Observations on* Lepton Clarkiæ. By WILLIAM CLARK, Esq.

To the Editors of the Annals of Natural History.

GENTLEMEN, Norfolk Crescent, Bath, March 7, 1852.

I BEG you to insert the following addenda, relative to the specific characters of the new *Lepton Clarkiæ,* mentioned in the March 'Annals of Natural History,' N. S. vol. ix. p. 191. One of the distinguishing marks of the new species has been already alluded to,—the oblique rounded outline; but I have omitted to name another equally important, that the side anterior to the beaks is double the transverse length of the posterior one; whereas in all the other Leptons, of which I have more than a hundred examples, the beaks are nearly central, and they have more or less subangularity at the sides; therefore the oblique outline, rounded sides, and position of the beaks, are unerring guides to distinguish the *L. Clarkiæ* from its congeners. The last character is of such value, that it is desirable to add to those already published, after the word "*gerente*"—

Latus rostris anterius, quoad longitudinem transversam, duplo, posterius superat.

I also request to state, that I terminated my last paper in the 'Annals' above-quoted by observing, "I was all but convinced the *Lepton convexum* and *L. nitidum* were identical." This view has been shaken by the acquisition of some intermediate specimens. I therefore decline to speak further on this point until the animal of the *L. convexum* is observed. I have a full, though unpublished account of the *L. nitidum,* and as a fresh specimen

of the *L. convexum* has occurred, though unfortunately so collapsed as not to exsert the organs, I have great hope this summer of meeting with it in a living state.

I am, very faithfully, yours,

WILLIAM CLARK.

XXVI.—*On the* Cassidulidæ *of the Oolites, with descriptions of some new species of that family.* By THOMAS WRIGHT, M.D. &c.

[Concluded from p. 214.]

Dysaster analis, Agass.

SYN. *Dysaster analis*, Agass. Prodrome Mem. Neuch. vol. i.
Collyrites analis, Desmoulins, Tab. Synop. p. 368. no. 14.
Dysaster analis, Agass. Echin. Suisse, i. p. 6. tab. 1. fig. 12–14; Gressly, Jur. Sol. p. 76; Desor, Monogr. des Dysaster, p. 10. tab. 2. fig. 8–10; Agassiz and Desor, Cat. raisonné des Echinides, p. 32.

Test suborbicular, inclining to oval, more or less depressed, round and inflated anteriorly, slightly contracted posteriorly; dorsal surface convex, more declined from the vertex to the anus than from the vertex to the anterior border; anterior half forming the segment of a larger circle than the posterior half; vertex excentral; apical disc nearly central, at which the single ambulacrum and the antero-lateral ambulacra converge; the postero-lateral ambulacra meet at the distance of $\frac{7}{10}$ths of an inch behind the antero-laterals; anus nearly circular and prominent, situated in the middle of the posterior border about midway between the ambulacral arch and the basal angle; ventral surface flat, without undulations; mouth circular, situated in a depression about the junction of the anterior with the middle third of the ventral diameter; sides convex, suddenly declining from a slight median elevation.

Height 1 inch, antero-posterior diameter 1 inch and $\frac{8}{10}$ths, transverse diameter 1 inch and $\frac{7}{10}$ths.

Description.—The nearly ovato-orbicular circumference and depression of the dorsal surface, which is not uniformly convex, with the flatness of the ventral surface, form a group of characters by which this *Dysaster* is distinguished from its congeners. The anterior half of the body is fuller and more developed, and forms the segment of a larger circle than the posterior half.

The single ambulacrum, which is lodged in a slight depression on the anterior border, is wider than the others; the antero-lateral ambulacra form graceful curves on the anterior sides of

the shell, and with the single ambulacrum converge at the apical disc; the postero-lateral ambulacra are situated very far back, and occupy the posterior sixth of the antero-posterior diameter of the test; they converge at some distance above the anus at a point situated $\frac{7}{10}$ths of an inch behind the apical disc; a very large intermediate space is thereby formed for the development of the posterior pair of interambulacra, the converging point of the antero-lateral and postero-lateral ambulacra being proportionally further removed in this species than in its congeners. The interambulacral areæ are of unequal width, the anterior pair are the narrowest, the posterior pair are the widest, and the single interambulacrum is of intermediate dimensions; the anterior pair are convex and prominent, and give the front of the shell an inflated appearance; the posterior pair gradually decline towards the anus and the lateral borders, and form a broad saddle which extends across the back and sides of the test. The single interambulacrum is small, and destitute of the basal development so characteristic of the analogous area in *D. ringens* and *D. bicordatus.*

The dorsal surface is not uniformly convex; the anterior half is rounder and more inflated than the posterior half; the latter is more depressed on the back and more contracted on the sides than the anterior half, and forms the segment of a much smaller circle than it; the vertex is excentral and situated nearer the anterior than the posterior border, corresponding to about the apex of the single ambulacrum; the apical disc is nearly central, but its structure is not preserved in the specimen before me; according to Agassiz, the holes in the four ovarial plates are very small, and their position is not regular; in general, the one corresponding to the right posterior interambulacral area is behind that of the left side.

The anal opening is situated in the posterior border about midway between the arch formed by the postero-lateral ambulacra and the angle of the shell; the aperture is large, prominent, and of an elliptical or nearly circular form; the ventral surface is flat, and in this respect presents a striking contrast to its congeners. In some of the best preserved specimens, the subanal prominence formed by the interambulacrum, and which is so prominent in *D. ringens,* is absent in *D. analis.* The mouth-opening, of a circular form, is situated in a slight depression near the anterior border, at the junction of the anterior with the middle third of the base. It has been remarked by Agassiz, who had the advantage of examining a suite of perfect specimens of this species from the Inferior Oolite of Switzerland, that the ambulacral plates diminish sensibly in depth when traced from the mouth to the points of convergence of the ambulacra; as each

plate corresponds to a pair of pores, it follows that these are much more closely set together on the dorsal than on the ventral surface; the interambulacral areæ are very large; the plates have a crescentic form, the lower border being convex, and the upper border more or less concave; by reason of the great distance between the antero-lateral and postero-lateral ambulacra, the plates forming the posterior pair of interambulacral areas are much larger on the dorsal surface of the shell than their analogues of the anterior interambulacra. The tubercles are very uniformly distributed upon the surface of the test, but are more numerous upon the inferior than the superior surface. The epiderm which covered the whole presented a finely granular aspect*.

Affinities and differences.—This Urchin resembles *D. ovalis*, but is distinguished from it by the unequal convexity of the dorsal surface, the flatness of the base, and the greater proportional distance between the points of convergence of the antero-lateral and the postero-lateral ambulacra; the form and structure of the areæ are likewise different; in fact these characters form a good diagnosis between *D. analis* and its congeners. Moreover *D. analis* is found only in the Inferior Oolite, and *D. ovalis* is limited to the Coralline Oolites.

Locality and stratigraphical range.—The imperfect specimen before me was obtained from the ferruginous beds of the Inferior Oolite at Dundry; it belongs to the Bristol Institution, and I am indebted to the kindness of my friend Mr. Etheridge, the Curator, for permission to describe the same. This species was found by MM. Gressly, Hugi and Stromeyer in the Inferior Oolite of Goldenthal and Fringeli (canton de Soleure†), and in the Marn. vésul. (Inferior Oolite) of Wallenburg, Egg et Burg (Argovie), le Mont-Terrible, Saint Maixant, by Bronn, Thurmann and D'Orbigny‡.

History.—Figured and described for the first time by Agassiz in his 'Echinodermes Fossiles' from specimens collected in the Canton of Soleure, and subsequently by the authors cited in our synonyma of this species, and now identified as a British Urchin for the first time. *D. analis* must be rare, as the specimen before me is the only one I have met with in all the collections I have examined with the view of ascertaining the species of Echinoderms contained in our Oolitic system.

* Echinodermes Foss. de la Suisse, 1st Part, p. 7.
† Agass. Echinoderm. Foss. p. 6.
‡ Annal. des Sciences Nat. tom. viii. p. 32.

2. Group of Nucleolides *.

Ambulacra petaloid; mouth subcentral, margin sometimes surrounded with prominent lobes.

Genus Nucleolites, Lamarck.

Test oval, cordate, or orbicular, more or less tumid, sometimes much depressed; covered with small imperforate tubercles, surrounded by a circular depression; ambulacra petaloid on the dorsal surface, forming straight narrow valleys on the base; pores widely separate and united by transverse delicate lines above, and placed close together in pairs, which are more widely apart at the base; mouth-opening subcentral, more or less pentagonal, with or without marginal folds; anal opening supramarginal, situated in a valley more or less deep formed by the single interambulacral area, commencing near or at a short distance from the apical disc; vertex always excentral; apical disc situated near the vertex, and formed of two pairs of perforated ovarial plates, and a single imperforate plate composed of one or more pieces, having the spongy body attached to its surface, and five small ocular plates arranged around the angles of the ovarials.

Nucleolites clunicularis, Llhwyd.

Syn. *Nucleolites scutata*, Lam. Animaux s. Vert. tome iii. p. 36.
Nucleolites clunicularis, Bronn, Lethæa Geognost. p. 282.
—— *scutatus*, Agass. Echinoderm. Foss. Suisse, t. vii. fig. 19–21. p. 45.
—— *depressa*, De Blainv. Zoophyt. p. 188.
Spatangus depressus, Leske, ap. Klein, tab. 51. fig. 1, 2. p. 238.
Clypeus clunicularis, Phillips, Geol. of Yorksh. Part 1. p. 115. pl. 7. fig. 2.
Echinites clunicularis, Llhwyd, Lith. Brit. Ichnogr. p. 48. No. 988.

Test subquadrate in circumference, anterior border rounded, posterior border bilobed; upper surface convex, declining abruptly anteriorly, and more gently posteriorly; vertex excentrical, at which is situated the apical disc; ambulacra narrowly lanceolate above and converging below; anal furrow deep, lanceolate, and extending to the posterior border of the apical disc; posterior lobes gently tapering, not tumid; base concave and grooved by the five ambulacral valleys; mouth slightly pentagonal, and situated nearer the anterior than the posterior border.

* The group of Nucleolides comprehends eleven genera: *Nucleolites*, Lam.; *Cassidulus*, Lam.; *Catopygus*, Agass.; *Pygaulus*, Agass.; *Archiacia*, Agass.; *Pygorhynchus*, Agass.; *Pygurus*, Agass.; *Echinolampas*, Gray; *Amblypygus*, Agass.; *Conoclypeus*, Agass.; *Asterostoma*, Agass.

Height $\frac{12}{20}$ths of an inch, antero-posterior diameter 1 inch and $\frac{3}{10}$ths, transverse diameter 1 inch and $\frac{5}{20}$ths (Inferior Oolite specimen).

Height $\frac{13}{20}$ths, antero-posterior diameter 1 inch and $\frac{2}{10}$ths, transverse diameter 1 inch and $\frac{1}{10}$th (pyramidal variety from the Cornbrash).

Description.—This Urchin has been long known to naturalists, and the list of synonyms shows some of the names under which it has been described; it presents many varieties of outline as well as of height, and these forms have sometimes been mistaken for and described as distinct species by different authors, so that much confusion has been made regarding its identity. The suite of specimens before me, from the Inferior Oolite, Great Oolite, and Cornbrash, vary from a suborbicular to a nearly quadrate outline, presenting all the intermediate forms: they are rounded anteriorly, a little contracted before, slightly swelled out at the sides, and more or less bilobed posteriorly. The dorsal surface is convex, exhibiting various degrees of elevation; in some it is much depressed, in others elevated into a subconical form. In the ten specimens before me, there are not two that have the same proportional height. The vertex is almost always excentrical, and inclined towards the anterior border, but the amount of this inclination, like the height, varies in different individuals: in a beautifully perfect specimen from the Cornbrash the vertex is quite central. The ambulacral areæ have a petaloid or lanceolate form with nearly parallel sides, the single area and the anterior pair are nearly of the same length and width, and the posterior pair are the longest and widest. The pores on the upper two-thirds of the dorsal surface are situated at some distance apart, and are united by fine sutures; at the inferior third of the area they approximate and pass from thence round the basal angle to the mouth; on the under surface the pores are very small and indistinct and set widely apart. The interambulacral areæ are of unequal width, the posterior pair are nearly one-fourth wider than the anterior pair, and the single area is the widest. The anal valley extends from the disc to the basal angle; it is of a lanceolate form with vertical parallel walls, which gradually diverge and then approximate, and afterwards expand outwards, forming a well-defined groove; the round anal opening is perforated at the extreme end of the valley; the whole surface of the test is covered with small close-set tubercles, surrounded by circular depressions, and having the interspaces minutely granulated; those on the dorsal surface are quite microscopic, whilst those on the base are larger and better defined. The apical disc is formed of two pairs of perforated ovarial plates, and a single imperforate plate with a central element having a spongy

body attached to its surface, around which the five ovarial plates are arranged; the ocular plates are lodged at the apices of the ambulacra, at which point the eyeholes are seen sometimes drilled in the border of the plates, sometimes formed between the ocular plates and the apices of the ambulacra. The surface of the ovarial and ocular plates is covered with microscopic granules.

The base is more or less concave, most so in the pyramidal varieties, and is slightly undulated; the ambulacra radiate in straight lines from the mouth, and the interambulacra form slightly convex pyramids between them. The mouth-opening is excentrical and situated in a deep depression nearer the anterior than the posterior border.

Affinities and differences.—This species very much resembles *N. dimidiatus*, but is distinguished from that species by its tapering posterior lobes, which are more tumid in *N. dimidiatus*, by the extent of the anal valley, which in *N. clunicularis* extends from the disc to the margin, whilst in *N. dimidiatus* there is a smooth portion of the test between the disc and the commencement of the valley: from *N. orbicularis* this species is distinguished by its subquadrate form, increasing sides, and bilobed posterior extremity; it wants likewise the general tumidity so characteristic of *N. orbicularis*, which it resembles in the length of the anal valley.

Locality and stratigraphical range.—We have collected this Nucleolite from the upper ragstones of the Inferior Oolite of Rodborough, Coopers, Birdlip, and Leckhampton Hills; it is not however a common species. It is found in the Great Oolite at Minchinhampton and Cirencester, in the Cornbrash of Gloucestershire, Wiltshire, Northamptonshire, and Yorkshire: the Inferior Oolite specimens are the most orbicular and depressed, the Great Oolite ones are the smallest, and the Cornbrash are the most pyramidal in form.

Its foreign distribution, according to Agassiz and Desor *, is "Oxford d'Alençon, Courgains (Sarthe), Calc. à Polypiers de Ranville, Coulie. Var. *minor*. Forest marble de Châtelcensoir." Form *latiporus*, "Cornbrash de Meltingen (Cant. de Soleure), Maiche (Doubs). Form *gracilis*, Ool. Ferrug. de Dürrenast (Jura Soleurois)."

History.—It would carry us far beyond our limits to attempt to trace the history of this species from Llhwyd to Agassiz; but even had it been otherwise it would have been unnecessary, as this has been so ably done by Professor Forbes in his 'Memoirs of the Geological Survey,' to the 1st Decade of which the reader

* Catalogue raisonné des Echinides: Annales des Sciences Naturelles, tome vii. p. 153, 3e série.

is referred for an excellent critical examination of the literature of this species; in the same work it is most elaborately figured and correctly described.

Nucleolites dimidiatus, Phillips.

Syn. *Nucleolites dimidiatus*, Phillips, Geol. of Yorksh. vol. i. pl. 3. fig. 16; Forbes, Memoir of Geol. Survey, Decade 3. description of pl. 9; Agassiz and Desor, Cat. raisonné des Echinides.
Nucleolites paraplesius, Agassiz, Catalogue Syst. p. 4.

Test ovate or subquadrate, compressed at the sides, rounded anteriorly, expanded and bilobed posteriorly, dorsal surface convex; apical disc central, vertex excentral, anterior and lateral border and posterior lobes tumid; ambulacra narrow and lanceolate; anal valley deep, ovate or obtusely lanceolate, extending about two-thirds of the space between the border and the vertex, and terminating at a distance from the disc; base concave, much depressed at the mouth-opening, which is pentagonal and excentral.

Height $\frac{6}{10}$ths of an inch, antero-posterior diameter 1 inch and $\frac{3}{20}$ths, transverse diameter 1 inch and $\frac{1}{10}$th.

Description.—This species was formerly considered a variety of *N. clunicularis*, but was correctly separated from that form by Mr. Phillips. It does not appear to deviate so much from its typical outline as that species; the greater fullness of the sides, the tumidity of the posterior lobes, and the shortness of the anal valley are characters which are very uniformly preserved in the individuals now before me. The single and the anterior pair of ambulacra are narrower than the posterior pair, they have a lanceolate form, rather obtuse at the apex; the pores are set at short distances apart; on the dorsal surface they become approximated near the margin, and pass from thence to the mouth in pairs, set however more widely apart at the base. The interambulacra are of unequal width, the posterior pair are nearly one-third wider than the anterior pair; the single area has a cordate form from the development of the posterior lobes, and equals in width that of the posterior areæ. The anal valley forms one of the distinctive characters of this species; it is of an ovate or lanceolate form with a blunt apex, and in some individuals it has the appearance of a portion of the test having been drilled out of the single area; in some specimens it extends only half the distance between the margin and the vertex, whilst in others it reaches two-thirds that length, but in all the individuals before me there is an undepressed portion of the test separating the apical disc from the superior border of the anus; inferiorly the valley forms a considerable sulcus, which grooves the centre of the single area, divi-

ding its posterior border, and producing the cordate bilobed form it assumes; the surface of the test is irregularly covered with small tubercles, which are of microscopic minuteness above, but are larger below, and are surrounded by a circular depression; the vertex is excentral, behind which the apical disc is situated; it is nearly central in some individuals, and quite so in others, and is formed of two pairs of perforated ovarial plates, and a single imperforate plate; the madreporiform body occupying the centre of the disc, and the five small ocular plates are seen at the apices of the ambulacra. The base is more or less concave, and deeply so at the point where the mouth-opening is placed; this aperture has a pentagonal form, and is much nearer the anterior than the posterior border. The ambulacra form valleys that are scarcely perceptible in passing from the border to the mouth.

Affinities and differences.—In its general outline *N. dimidiatus* resembles *N. clunicularis*, but is distinguished from that species by its ovate anal valley, which extends only two-thirds of the length of the dorsal surface of the single interambulacrum, whereas in *N. clunicularis* it reaches from the apical disc to the margin; the tumidity of the sides and posterior lobes afford additional diagnostic characters. It is so entirely distinct from the other Oolitic congeneric forms, that it cannot be mistaken for either of them.

Locality and stratigraphical range.—This species has been collected from the Coralline Oolite of Calne and Steeple Ashton, Wilts, and of Malton and Filey Bridge, Yorkshire; it is found likewise in the same stage in Oxfordshire and near Havre.

History.—First figured as a species distinct from *N. clunicularis* by Mr. Phillips in his 'Geology of Yorkshire,' and now described in detail for the first time.

Nucleolites orbicularis, Forbes.

Syn. *Clypeus orbicularis*, Phillips, Geol. of Yorksh. vol. i. pl. 7. fig. 3.
Nucleolites orbicularis, Forbes, Mem. of Geol. Survey, Decade 1. description of pl. 7.

Test orbicular, dorsal surface irregularly convex and depressed; sides tumid; vertex and apical disc central; ambulacra lanceolate; anal valley narrow, extending from the disc to the border; posterior lobes obsolete; base flat, slightly concave; mouth subcentral, situated in a depression.

Height $\frac{6}{10}$ths of an inch, antero-posterior diameter 1 inch and $\frac{1}{20}$th, transverse diameter 1 inch and $\frac{3}{20}$ths. One large specimen is $1\frac{1}{2}$ inch in diameter, but its proportional dimensions cannot be ascertained, as it is crushed.

Description.—The orbicular circumference, tumid sides, obsolete lobes, and broad, flat, and somewhat irregular dorsal surface distinguish *N. orbicularis* from its congeners. The ambulacra are nearly all of the same width; they have a more petaloid form than in the preceding species, in consequence of the pores being set farther apart and connected by deeper sulci; near the margin of the test the pores become very small and approximated, on the base they are very indistinct and more widely apart, and continue so to the mouth. The interambulacra are unequal, but less so than in *N. clunicularis* and *N. dimidiatus,* and the single area is the widest. The test is covered with microscopic tubercles; so minute in fact are they, that without the aid of a good lens the surface appears quite smooth. The anal valley is narrow, and extends from the vertex to the margin. The base is concave and slightly undulated from the convexity of the interambulacra and the straightness of the ambulacra. The mouth is excentral and slightly five-lobed. The apical disc is broad, and formed of two pairs of large perforated and a single imperforate ovarial plate, having the madreporiform element occupying the centre thereof; the size of the ovarial plates occasions a greater distance between the ocular plates, which are consequently more apart than in the other species. The test is very thin, and the spines, which are preserved in one individual, are moderately long and needle-shaped.

Affinities and differences.—The orbicular form and long anal valley liken *N. orbicularis* to some individuals of *N. sinuatus*; from them however it is distinguished by the tumidity of the sides and flatness of the dorsal surface; it is known from *N. Hugii* by the anal valley extending from the disc to the margin, whereas in the latter species the upper anal border is separated from the vertex by an undepressed portion of the shell; from the other *Nucleolites* of our Oolites it is very distinct.

Locality and stratigraphical range.—It is found in the Inferior Oolite of Rodborough Hill, the Great Oolite of Minchinhampton, and Salperton Tunnel, Great Western Railway, and the Coralline Oolite of Calne, Wilts. Mr. Phillips's specimens were collected from the Cornbrash near Scarborough; it has likewise been found at Wollaston near Wellingborough, Northamptonshire.

History.—Figured by Mr. Phillips in his 'Geology of Yorkshire,' but not described in that work; enumerated by Professor Forbes in his note on "British *Nucleolites*" appended to the description of the 9th plate of his 1st Decade *, and now described in detail for the first time.

* Mem. of the Geol. Survey of Great Britain.

Nucleolites Hugii, Forbes.

SYN. *Clypeus Hugi*, Agassiz, Echin. Foss. Suisse, vol. i. p. 37. tab. 10. fig. 2–4.

Nucleolites Hugii, Forbes, Mem. Geol. Surv. Decade 1. description of pl. 9.

Test suborbicular, dorsal surface convex and depressed; apical disc and vertex subexcentral; ambulacra lanceolate, apices approximated; anal valley oblong, obtuse and short, separated from the vertex by a considerable portion of undepressed test; single interambulacrum produced and much deflected; posterior lobes small; base concave and undulated; mouth much excentral near the anterior border, of a pentagonal form and surrounded by five lobes.

Height $\frac{15}{20}$ths of an inch, antero-posterior diameter 1 inch and $\frac{13}{20}$ths, transverse diameter the same as the antero-posterior.

Description.—This is a very distinct form of *Nucleolite*; the circumference is suborbicular, sometimes a little compressed at the sides; the dorsal surface is convex, and the antero-posterior exceeds the transverse diameter in some, and these diameters are nearly equal in other individuals. The ambulacra have a lanceolate form; the single ambulacrum and the anterior pair are nearly the same width, and the posterior pair are the widest; their apices approximate very closely in consequence of the smallness of the apical disc. The pores are not far apart on the dorsal surface; the internal row consists of small round holes, the external row are somewhat elongated transversely, and unite with the internal row by a delicate suture; near the border they approximate and are disposed in close-set pairs. As we trace them from the basal angle to the mouth they lie widely apart, but near the mouth they become again more closely approximated, and fall into triple oblique pairs as in *Echinus* and *Pedina*. The anterior pair of interambulacra are the narrowest, the single interambulacrum is the widest, and the posterior pair are of intermediate dimensions; the anterior border is obtusely rounded, the sides swell gradually outwards to the junction of the posterior pair with the single area, which is the widest part of the test; the single interambulacrum is slightly produced and much deflected; the anal valley is short and oblong, with an obtuse upper margin, which does not extend one half the distance between the border and the vertex, the space between the anal margin and the vertex being occupied by a smooth undepressed portion of the test: this character allies *N. Hugii* to *N. dimidiatus*; but the orbicular outline, the greater size, and the produced and deflected single interambulacrum of the former constitute a group of characters by which it is readily distinguished from the latter

species. The base is concave and undulated, the ambulacra forming straight valleys, and the interambulacra more convex elevations than in any other of its congeners. The mouth is very excentral, being situated near the junction of the anterior with the middle third of the basal antero-posterior diameter; the opening has a pentagonal form, and is surrounded with five small lobes. The apical disc occupies the vertex, which is slightly excentral, inclining towards the posterior border; it is formed of two anterior and two posterior perforated ovarial plates with a single imperforate plate and a spongy madreporiform body occupying the centre; the ocular plates are small, and the orbits appear to be formed by the apices of the ambulacra and the margin of the ocular plates. The test is moderately thick, its surface is closely covered with small tubercles surrounded by a circular depression, and the intertubercular spaces are delicately sculptured with microscopic granules; the tubercles on the dorsal surface are much smaller than those on the base.

Affinities and differences.—This species resembles *N. orbicularis* in its suborbicular form, but is readily distinguished from that species by its declining sides and the absence of the general tumidity so characteristic of *N. orbicularis*; the form and structure of the anal valley are likewise different; in *N. orbicularis* it extends from the margin to the apical disc, whilst in *N. Hugii* it occupies only the inferior half of the single interambulacrum; that area is likewise more produced and much deflected in *N. Hugii.* From *N. dimidiatus*, *N. Hugii* is readily distinguished by the inferior position of the anal opening, the deflected lip-like form of the single interambulacrum, and the rudimentary condition of the posterior lobes; the size and suborbicular outline of *N. Hugii* form likewise a strong contrast to the small oblong form of *N. dimidiatus.*

Locality and stratigraphical range.—I have collected *N. Hugii* from the Inferior Oolite of Rodborough Hill, and a mutilated specimen from the upper ragstones of Leckhampton Hill; it is therefore a rare Urchin in Gloucestershire. Its foreign distribution, according to Agassiz, is Inferior Oolite du Jura Soleurois et Evêché de Bâle, le Mont-Terrible (Cant. de Berne). As far as I can learn, it has hitherto been found only in the Inferior Oolite.

History.—First figured and described by Agassiz in his 'Echinodermes Fossiles de la Suisse,' identified in the British Museum collection as a British Urchin by Mr. S. P. Woodward, enumerated in Prof. Forbes's note on "British *Nucleolites,*" and now described in detail as such for the first time.

Nucleolites Solodurinus, Wright.

Syn. *Clypeus Solodurinus*, Agassiz, Echin. Foss. Suisse, vol. i. p. 35. tab. 5. fig. 1–3.

Test oblong, posterior border much produced, deflected and truncated; ambulacra petaloid, apices approximated; vertex and apical disc excentral, inclined towards the posterior border; anal valley narrow, acutely lanceolate, extending from the vertex to the posterior border; base concave; mouth excentral, surrounded by five well-developed lobes.

Height $\frac{13}{20}$ths of an inch, antero-posterior diameter 2 inches, transverse diameter 1 inch and $\frac{8}{10}$ths.

Description.—This Urchin is distinguished from its congeners by its oval circumference, depressed dorsal surface, and produced and truncated posterior border. The ambulacral areæ are formed of very narrow plates, have a regular acutely lanceolate or petaloidal form, a nearly uniform width and closely approximated apices; and the pores are placed further apart, and connected by finer and more close-set sulci than in *N. Hugii*, which gives more breadth to these divisions of the test; above the marginal angle the pores approximate, on the base they are wide apart, but within a short distance, about 4 lines, from the mouth they become more numerous and form close-set triple oblique pairs. The interambulacra are of unequal width, the anterior pair are the narrowest, the posterior the widest, and the single interambulacrum about the same as the latter; this area is much produced, deflected, and abruptly truncated posteriorly; the anal valley is narrow, deep, and acutely lanceolate, extending from the apical disc to the border. The vertex is excentral and slightly inclined posteriorly; the apical disc is small and situated immediately behind the vertex; it is formed of an anterior pair and a posterior pair of oblong perforated ovarial plates, and a single imperforate ovarial plate, with a spongy madreporiform body occupying the centre of the disc. The ocular plates are small, and the eyeholes near the margins. The base is concave and undulated, the ambulacra forming straight valleys, and the interambulacra convex elevations between. The mouth is pentagonal and excentral; its margin is surrounded by five lobes, the terminal portions of the interambulacra, between which are notches formed by the contracted ambulacra, which are here freely perforated for the passage of tubular organs, which appear to have been very numerous around the mouth. The test is moderately thick; its surface is covered with small tubercles surrounded by circular depressions, as in the other species of this genus; the tubercles on the base are larger than those on the dorsal surface.

Affinities and differences.—*N. Solodurinus* more nearly resem-

bles *N. sinuatus* than any other species, having with it affinities in the form and structure of the ambulacra, the narrowness and extent of the anal valley, and the depression of its dorsal surface; it is distinguished however from *N. sinuatus* by its oblong circumference, produced single interambulacrum, which is more flattened, deflected, and abruptly truncated than in that species. The dorsal surface is likewise more depressed; in fact, the angular outline and produced and truncated posterior border separate *N. Solodurinus* from all its congeners.

Locality and stratigraphical range.—This is a rare species; it was collected by Mr. S. P. Woodward from the upper beds of the Inferior Oolite near Stroud, and to whom we are indebted for the loan of the specimen which has served for the foregoing description. We have a broken specimen from the same beds near Salperton Tunnel, Great Western Railway: in the Museum of Economic Geology there is a specimen from the Inferior Oolite of Dorsetshire. Its foreign distribution, according to Agassiz and Desor's 'Catalogue raisonné,' is "Marn. vésul. Obergoeschen (Jura Soleurois), Egg (Argovie), Poligny (Jura)."

History.—First figured and described by Agassiz in his 'Echinodermes Fossiles de la Suisse,' afterwards identified as a British fossil by Mr. S. P. Woodward, and now described as such for the first time.

Nucleolites sinuatus, Leske.

SYN. *Clypeus sinuatus*, Leske apud Klein, Echinod. p. 157. tab. 12; Parkinson, Organic Remains, vol. iii. pl. 2. fig. 1.
Galerites patella, Lamarck? Syst. Animaux, tom. iii. p. 23. no. 14.
Clypeus patella, Agassiz, Echin. Foss. vol. i. p. 36. t. 5. fig. 4–6; Agassiz and Desor, Cat. raisonné des Echinides, A. S. N. tom. vii. p. 156.
Nucleolites patella, Defrance, Dict. Sc. Nat. tom. xxxv. p. 213; Desmoulins, Tabl. Synopt. no. 3. p. 354.
Echinoclypeus patella, De Blainville, Zoophytologie, p. 189.

Test orbicular, dorsal surface convex, depressed, sides sloping; vertex nearly central; ambulacral areæ broadly lanceolate, apices closely approximated; apical disc excentral, behind the vertex, and inclined posteriorly; anal valley narrowly conical, shallow, with inclining sides extending from the apex to the border; posterior lobes small; base concave and undulated; mouth excentral and pentagonal, margin with five lobes.

Height 1 inch and $\frac{6}{10}$ths, antero-posterior diameter 4 inches and $\frac{5}{10}$ths, transverse diameter 4 inches and $\frac{4}{10}$ths.

Description.—This large buckler-shaped Urchin has been long known to palæontologists from the abundance and fine preservation in which its test is found in the lower and middle division

of the Oolites. It exhibits many changes of form in the different strata, attaining however its greatest development in the upper beds of the Inferior Oolite, from whence the specimen now before me was obtained. The ambulacra are broadly lanceolate, the single area and the anterior pair are about the same length and width, and the posterior pair are shorter and wider on the dorsal surface, and longer than the others on the base. The pores are placed widely apart, as much as $\frac{2}{10}$ths of an inch at the widest space; they are united by transverse sulci formed by the sutures of the small plates of the ambulacral areæ; the poriferous avenues are more depressed, and exhibit the lines of union more distinctly than the plates occupying the interporous space, which are upon a level with the interambulacral plates, and like them are covered with tubercles; the separation of the pores and their union by transverse sutures extends to the margin of the test, at the basal angle they become approximated, and from thence to the mouth they form triple oblique pairs placed wider apart. The interambulacra are of unequal width; the anterior pair are the narrowest, the single area is the widest, and the posterior pair are of intermediate dimensions. In large specimens there is a slight depression down the centre of each area in the line of the median suture; the anal valley is narrow above and expanded below; it is of an inconsiderable depth, has an acutely conical form with inclining walls, and extends from the apical disc to the border. The anal opening is situated about the middle of the valley, the area is slightly produced and deflected, and an inconsiderable concavity is formed in its centre corresponding to the boundary of the valley. The test is thick, and its surface is profusely covered with small tubercles, so arranged that they form oblique lines; the tubercles are surrounded by circular depressions, and the intertubercular surface is occupied by microscopic granules. The vertex is nearly central, inclining in general to the posterior border, behind which the apical disc is placed, formed of two pairs of perforated ovarial plates, and a single imperforate plate which extends into the anal valley, the centre of the disc being occupied by the spongy madreporiform body; the ocular plates are small, and have the eye-holes near their margins.

The base is flat, inclining to concave; the mouth-opening is excentral and pentagonal, being situated nearer the anterior than the posterior border, and having its margin surrounded by five prominent lobes; the ambulacra form straight narrow valleys, and the interambulacra are slightly convex, which occasions gentle undulations on the basal surface, as in other *Nucleolites*; the tubercles are a little larger on the base than on the dorsal surface.

Affinities and differences.—This large species resembles *N. Agassizii* in size and outline, but is clearly distinguished from it by the flatness of the dorsal surface, the length and narrowness of the anal valley, and the absence of the undepressed portion of test which is so conspicuous in *N. Agassizii.* It resembles *N. Solodurinus* in the form and length of the anal valley, but differs from it in having an orbicular circumference, and in the absence of the produced, deflected, and truncated posterior border so characteristic of that species; from *N. Hugii* it is distinguished by the extension of the anal valley from the disc to the border, and the inconsiderable deflection of the single interambulacral area. After a careful examination of an extensive suite of specimens from the Inferior Oolite and Great Oolite, we have come to the conclusion that *C. patella,* Ag., and *C. excentricus,* M'Coy, are not distinct species, but merely varieties of *N. sinuatus*; as we have before us a series exhibiting the forms which M. Agassiz and Prof. M'Coy have considered as specifically distinct, with the intermediate forms through which they blend into the true typical *N. sinuatus.* Without several individuals from different localities, it is at all times hazardous to attempt to establish a new species of Urchin on form alone, as the same species often changes its form in different beds and even in the same bed in different localities; these modifications of form constitute at most varieties, which depended upon some temporary change of the conditions in which they lived, without in any way affecting the distinctive structural character of the species.

Locality and stratigraphical range.—*N. sinuatus* has a wide vertical range, being found very abundantly, and of its largest size, in the upper beds of the Inferior Oolite of Gloucestershire, in the Great Oolite of Minchinhampton, and Kiddington (Oxon), and the Cornbrash and Coralline Oolite of Wilts; in Yorkshire it is found in beds of the same ages. According to Agassiz and Desor the foreign distribution of this species is, "Inferior Oolite, Boulogne-sur-mer; Chayul (Ardennes); Montanville, Flincy (Meuse); Metz, Noviant, Besançon, Porrentruy, Salins (Jura); environs de Bâle."

History.—This species, as the synonyms prove, has been long known to naturalists; it is so abundant in some localities in Gloucestershire, that the farmers believe this Urchin grows in the soil, from the numbers that are successively turned up by the plough every year.

Nucleolites Agassizii, Wright, n. sp. Pl. III. fig. 3 *a–c.*

Test conoidal, with a nearly circular margin; ambulacral areæ depressed, concave and petaloid, anterior pair much inclined;

apices remote; pores widely apart; interambulacral areæ nearly of the same width; vertex central; apical disc excentrical, and inclined backwards; anal opening of an oblong form, situated in a shallow valley in the middle of the single interambulacrum; between the upper anal border and the disc there is a considerable undepressed portion of the test; base flat and very slightly undulated; mouth nearly central, pentagonal, and surrounded by five prominent lobes; the tubercles on the dorsal surface are quite microscopic, those on the base are a little larger and more distinct.

Height 2 inches and $\frac{2}{10}$ths, antero-posterior diameter 4 inches and $\frac{3}{20}$ths, transverse diameter 4 inches.

Description.—This noble Urchin preserves the conoidal elevation of its dorsal surface in all the individuals we have examined. The circumference is nearly orbicular, the antero-posterior being somewhat greater than the transverse diameter; the dorsal surface of the test is uneven in consequence of the ambulacra forming concave depressions, which have a petaloidal form, and are of a nearly uniform width; the single area and the inferior pair are the longest, the latter are much inclined, and the posterior pair are slightly flexuous; the central space between the pores is narrow, and lies lower than the general surface of the interambulacra. The pores are situated at a considerable distance apart on the dorsal surface and become approximated at the basal angle, where they fall into close-set pairs, from thence to the mouth they are arranged in triple oblique rows; the pores are extremely small and indistinct on the basal surface. The interambulacral areæ are very uniform in width and convexity on the dorsal surface, the anterior pair are the longest, and the single area has a remarkable form arising from the shallowness of its anal valley, and the superficial position of the anal opening which forms an oblong depression in the middle of the area; between the upper border of the opening and the disc there is a smooth, slightly depressed portion of the test to the extent of an inch, which is the rudiment of the furrow so much developed in some *Nucleolites*, and which forms one of the most important diagnostic characters of our species; from the lower border of the opening the test is depressed, the limits of the depression being bounded by two elevations; the basal angle of this area is very slightly produced and deflected, the posterior lobes are entirely obsolete. The vertex is central, and at a short distance behind it the apical disc is situated, which is considerably inclined towards the posterior border, and formed of an anterior and a posterior pair of perforated ovarial plates, and a single imperforate plate with a large central portion, having a spongy madreporiform body attached to its surface, and

which occupies the centre of the disc; the five ocular plates are small, and so firmly soldered to the ovarials that the line of the sutures is entirely effaced. The base is flat and slightly undulated, the interambulacral segments being moderately convex and separated from each other by the straight, narrow ambulacral valleys. The mouth is nearly central, of a pentagonal form, and surrounded by five prominent lobes formed of the terminal folds of the interambulacra; the tubercles on the dorsal surface are very small and numerous, so that without the aid of a lens the test appears smooth; on the basal surface they are larger, but are still comparatively small for so large an Urchin.

Affinities and differences.—N. Agassizii resembles *N. sinuatus* in size, but is readily distinguished from that common species by the following diagnostic characters. In *N. Agassizii* the dorsal surface is conoidal, the ambulacra are concave and depressed, the anal opening is oblong and nearly superficial; there is a considerable extent of the test very slightly depressed between the upper border of the opening and the disc, whilst in *N. sinuatus* the anal valley extends from the disc to the border. The tubercles are much smaller, and the dorsal surface is almost smooth. The apical disc is large, superficial, and excentrical.

Locality and stratigraphical range.—This Urchin was collected from the sands of the Inferior Oolite in the neighbourhood of Bridport. It occurs likewise near Ilminster in beds of the same age. I know of no specimens in Gloucestershire. I dedicate this species to Professor Agassiz, whose numerous monographs on the Echinoderms, living and fossil, have so materially contributed to advance our knowledge of this class.

Nucleolites emarginatus, Forbes.

SYN. *Echinites subulatus,* Young and Bird, Geol. Surv. York. Coast, p. 214. pl. 6. fig. 11.

Clypeus emarginatus, Phillips, Geol. of Yorksh. p. 127. pl. 3. fig. 18.

Nucleolites emarginatus, Forbes, Mem. of the Geol. Surv. Decade 1. description of pl. 9.

"Test orbicular, sides declining, dorsal surface subdepressed; vertex and apical disc nearly central; ambulacra broadly lanceolate, with their apices approximated; anal valley very short, far removed from the vertex, obtuse and marginal; posterior lobes obsolete."—*Forbes.*

Antero-posterior and transverse diameters about 4 inches.

We could not succeed in obtaining a specimen of this *Nucleolite*; it is said to be rare. Mr. Young observes, "that the dorsal surface has the same elegant markings as No. 5 (*Pygurus pentagonalis*), but the petals are rather oval shaped than lanceolate, from which peculiarity we name it *Echinites subulatus.*

The middle part of each petal forms a slight ridge; on the contrary, the five corresponding marks on the base meeting in the mouth are depressed. The base is concave. The mouth is situated immediately under the vertex. The vent is in a short groove, on the edge, but more towards the upper surface, as in some of the *Spatangus* family."

Affinities and differences.—The marginal position of the anal valley forms a sufficient diagnosis between *N. emarginatus* and its congeners, but the want of a specimen prevents us making a comparison between it and them; the petaloidal ambulacra and position of the anus bring this Urchin into near affinity with the genus *Pygurus.*

Locality and stratigraphical range.—It is found in the Coralline Oolite of Malton and Scarborough, and is said to be rare.

History.—This Urchin has been figured by Messrs. Young and Bird and by Mr. Phillips, but described by neither. Prof. Forbes has drawn up a good diagnosis of the species, but a detailed description is now a desideratum.

In the 'Catalogue raisonné des Echinides' of Agassiz and Desor there is a species entered under the name of *Clypeus rimosus,* described as "Espèce plate, discoide, à ambulacres costales," and stated to be from the Oolitic strata of Gloucestershire, and in the collection of M. Deluc; we know of no such species from the Oolites of this county, and suspect that it may probably be one of the many varieties which *N. sinuatus* presents in our different beds. There is a small *Nucleolite* in the British Museum from the Great Oolite of Harleston, apparently distinct and allied to *N. clunicularis*; in the same collection there is another small species from the Inferior Oolite of Stroud which is probably new*.

In Prof. M'Coy's paper "On some new Mesozoic Radiata †," there are two species described under the names of *N. planulatus* and *N. æqualis,* neither of which we know; the former is said to resemble *N. planatus* of Roemer, and the latter *N. latifrons* (*latiporus* ?), Agassiz, which is only an orbicular variety of *N. clunicularis* from the Cornbrash.

A careful comparison of these forms, with other typical species and the varieties thereof, is very desirable, as the creation of new species from transitory forms retards rather than advances palæontology.

Genus Pygurus, Agassiz.

Test discoid or ovoid, more or less elevated; anterior border flattened, posterior border rostrated; ambulacra having elegant petaloid forms; poriferous zones very large in the centre, much

* Prof. Forbes, Mem. Geol. Surv. Decade 1. pl. 9.
† Annals of Nat. Hist. vol. ii. Second Series, p. 416.

contracted at the vertex and towards the border; apical disc small, subcentral, and formed of four perforated and a single imperforated ovarial plate, with a small madreporiform body occupying the centre of the disc, and five ocular plates the angles between the ovarials at the circumference thereof. Interambulacra wide, the single area produced and deflected; anal opening round or longitudinally oval, situated in the infra-marginal border of the rostrated process. Ventral surface concave or subconcave; mouth subcentral and pentagonal, surrounded by five prominent lobes and a rosette of well-developed pores on the ambulacra near the opening. Tubercles close-set and microscopic. Most of the species are Oolitic, a few are found in the Neocomian strata, but all are extinct.

Pygurus Blumenbachii, Agassiz. Pl. IV. fig. 2 *a–c*.

SYN. *Clypeaster Blumenbachii*, Koch and Dunker, Norddeutschen Oolithgebild. pl. 4. fig. 1. p. 37.

Pygurus Blumenbachii, Agassiz and Desor, Cat. raisonné, A. N. S. tom. viii. p. 162.

Test thin, nearly orbicular, with a sinuous margin; dorsal surface elevated anteriorly, gradually declining posteriorly, border sinuous, with the centre produced and deflected; base concave, much undulated; mouth-opening excentrical, subpentagonal, with a five-lobed margin; anal opening submarginal, round or nearly ovate.

Height 1 inch and $\frac{1}{10}$th, antero-posterior diameter 2 inches, transverse diameter at the widest part 2 inches and $\frac{1}{10}$th.

Description.—This Urchin has a very remarkable form; the anterior border is slightly excavated in the centre, with two convex lobes on each side thereof. The lateral parts of the test are convex, and the posterior borders form two sinuous lines having the centre of the single interambulacrum produced posteriorly into a beak-shaped, slightly deflected process. The ambulacra have an elegant petaloid form with approximated apices; the poriferous avenues are marked by well-developed transverse sulci. The ambulacral areæ, which are wide above, rapidly converge towards the lower third; the pores here approximate and pass from thence in close-set pairs to the border of the test. Along the base the pairs are placed wide apart, but again become more closely approximated as they approach the mouth.

The interambulacra are unequal; the anterior pair are convex and prominent; they rise nearly perpendicular, forming an angle of 80°, and near the vertex curve backwards; the posterior pair and the single area slope at an angle of 35°. The dorsal surface thus acquires the anterior elevation which gives so remarkable a character to this species, and connects it with *P.*

Montmollini from the Neocomian stage. The single interambulacrum is remarkable from having a central elevation on its dorsal surface, two sinuous excavations commencing from the posterior pair of ambulacra, and a central produced and deflected portion. The vertex is excentral, in which the small apical disc is situated, formed of four perforated ovarial plates and a single imperforate plate, with the spongy madreporiform body occupying the centre and five ocular plates the apices of the ambulacra. The base is concave and much undulated, the ambulacra forming straight valleys from the border to the mouth, and the interambulacra convex eminences between them. Near the mouth their terminal portions form five very tumid lobes around the margin of that opening. The mouth is subpentagonal and placed diametrically opposite to the apical disc; it is consequently excentral and nearer the anterior border. The anal opening is not shown in our specimen; according to Koch and Dunker, it is somewhat ovate inclining to round, and is situated in the basal portion of the produced and deflected single area.

Affinities and differences.—This singular Urchin, in its elevated anterior dorsal surface, very much resembles *P. Montmollini*, Ag., from the Neocomian stage of Switzerland, and *P. trilobus* from the Craie chloritée of Maers; from the former it is distinguished by the more angular outline of the posterior border, from the latter it differs in having the central lobe less produced. The form, in fact, is intermediate between them.

Locality and stratigraphical range.—The specimen before me, I was assured, was collected from the ferruginous beds of the Inferior Oolite near Yeovil, and the lithological character of the matrix supports the statement. It has been found by the officers of the Geological Survey in the Coral Rag of Abbotsbury, Dorsetshire, a fine specimen of which is in the Mus. of Pract. Geol. Its foreign distribution is the Coral Rag de Jonnerre (Yonne) and of Waltersberg (Hanover).

History.—First figured and described by Koch and Dunker in their monograph on the 'Norddeutschen Oolithgebilde,' afterwards identified by Prof. Forbes in the collection made by the Geological Survey in Dorsetshire, and now described as a British Urchin for the first time.

Pygurus pentagonalis, Wright. Pl. IV. fig. 3 *a–e*.

Syn. *Echinanthites orbicularis*, Young and Bird, Geol. York. Coast, pl. 6. fig. 5.

Clypeaster pentagonalis, Phillips, Geol. of Yorksh. tab. 4. fig. 24.

Test with an ovoidal or subpentagonal circumference, much depressed on the dorsal surface; vertex nearly central, in which the apical disc is situated; ambulacral areæ petaloid, broad,

convex, and nearly equal; apices closely approximated; interambulacral areæ of unequal width, base much undulated; mouth nearly excentral; anal opening oval, inframarginal, and situated in a deep depression with inclining walls.

Height 1 inch and $\frac{2}{10}$ths, antero-posterior diameter 3 inches and $\frac{3}{10}$ths, transverse diameter 3 inches and $\frac{1}{10}$th.

Description.—This Urchin was first noticed by Mr. Young in the Coralline Oolites of Yorkshire. It has an ovoidal or subpentagonal form and is much depressed, the vertex is nearly central, and from the circumference of the small disc the broad petaloid ambulacra diverge. The anterior single ambulacrum is the narrowest, the posterior pair the widest, and the anterior pair of intermediate width, but the difference between the five ambulacra is very trifling; they have all a petaloid form and their apices are blunt and much approximated.

The space between the internal rows of pores is proportionally broad, and the pores are distant and connected by distinct sulci; about the inferior third of the ambulacra the pores approximate, from whence they pass in close-set pairs to the border of the test. The leaf-like form, therefore, which the ambulacra present is in a great measure owing to the disposition of the pores and their proximity or remoteness at different parts of their course. The interambulacra are of unequal width; the anterior pair are the narrowest, and the posterior pair and single area are alike in width; they are uniformly convex above. The single area is produced and deflected, and in this region the anus is situated; the apical disc, which occupies the centre of the vertex, is very small, depressed, and composed of four small perforated ovarial plates, and a single imperforate plate with a small central spongy body as in *Nucleolites.* The base is flat, somewhat concave, and much undulated in consequence of the ambulacra forming straight valleys and the interambulacra intermediate convexities. The anterior border is truncated, and as the left interambulacrum is not so much developed as the right, there is a slight inequality of the anterior border, which may however be only an abnormal variety; the anus occupies the extreme portion of the single interambulacrum, it is of an oval form, the long diameter corresponding to the antero-posterior diameter of the test, and is situated in a deep depression with highly inclined sides. The mouth is slightly excentrical, but is partly concealed by the matrix.

Affinities and differences.—This species so very much resembles *Pygurus* (*Clypeaster*) *Hausmanni* of Koch and Dunker, that we have been almost disposed to consider the latter as a gigantic example of this species. The dorsal surface of *C. Hausmanni* is flatter and more convex, the poriferous sulci are shorter, and the

anus forms a blunter oval. A comparison of these specimens is therefore very desirable, as size alone *cæteris paribus* does not constitute a specific character.

I have before me a large *Pygurus* from the Coralline Oolite of Malton, Yorkshire, belonging to the collection of the Bristol Institution, and kindly lent me for comparison by Mr. Etheridge the curator.

It so much resembles the *Clypeaster Hausmanni*, Dunk., in proportional measurements, whilst it exceeds that Urchin in size, that we think it identical with the German species: this *Pygurus* measures in height 1 inch and $\frac{2}{10}$ths; antero-posterior diameter 5 inches and $\frac{6}{10}$ths; transverse diameter 5 inches and $\frac{3}{10}$ths. The test is thin, the tubercles are small and numerous; the ambulacra are prominent, projecting above the level of the interambulacra, and describing similar petaloidal figures to those in *P. pentagonalis*; the ventral surface is inseparably united to the rock, and a portion of the single interambulacrum is fractured. Notwithstanding these defects, the likeness to *C. Hausmanni* is so great, and the structural affinities so numerous, that we think we are justified in our conclusion as to their identity: according to Koch and Dunker the dimensions of *Clypeaster Hausmanni* are —"Height 11 lines; antero-posterior diameter 4 inches and 7 lines; transverse diameter 4 inches and 2 lines. L : B : H =100 : 90 : 20." The *Pygurus* before us exceeds therefore by one-fifth in size this gigantic German Urchin.

Locality and stratigraphical range.—Pygurus pentagonalis has been collected from the upper rags of the Inferior Oolite at Shurdington Hill: it is a rare Urchin in these beds, as I only know of two individuals having been obtained therefrom; it has been found in the Inferior Oolite of the district round Bath, and was collected by Mr. Young and Mr. Phillips from the calcareous grit of Yorkshire. *P. Hausmanni*, which in some respects resembles our *P. pentagonalis*, was found in the Upper Coralline Limestone of Kleinenbremen near Bückeburg.

History.—I have not been able to compare our specimens with those from the Coralline Oolite of Yorkshire, but have every reason for believing that they are identical, although the figure in Mr. Phillips's work is certainly more pentagonal than ours.

In conclusion I take this opportunity of thanking Messrs. Brodie, Etheridge, Forbes, Fowler, Gavey, Jones, Lycett, Morris, Strickland, Walton, Wayte, Waterhouse, and Woodward for the loan of and permission to compare specimens, and Mr. W. H. Baily for the care he has taken to make out the details of our new species. I have subjoined a table which exhibits at one view the range and stratigraphical distribution of the Urchins described in the preceding papers.

A Tabular View of the Stratigraphical Distribution of the Jurassic Cidaridæ *and* Cassidulidæ *described in the preceding Papers.*

Genera and Species.	Authority.	Inferior Oolite.	Great Oolite.	Bradford Clay, Cornbrash, and Forest Marble.	Oxford Clay.	Calcareous grit and Coralline Oolite.
Cidaridæ.						
Cidaris Fowleri	Wright	*	...	...	...	...
Blumenbachii	Münster	...	...	...	...	*
propinqua	Münster	*	...	...	...	...
Hemicidaris intermedia	Fleming	...	*	*	...	*
icaunensis	Cotteau	...	*	...	...	...
alpina	Agassiz	...	...	*	...	...
granulosa	Wright	*	...	...	...	...
confluens	M'Coy	...	...	*	...	...
pustulosa	Forbes	...	*	...	...	...
Acrosalenia hemicidaroides	Wright	*	*	*	...	...
Lycetti	Wright	*	...	...	...	...
spinosa	Agassiz	...	*	*	...	...
decorata	Haime	...	...	...	...	*
Wiltonii	Wright	...	...	*	...	...
Diadema depressum	Agassiz	*	*	*	...	*
subangulare	Goldfuss	...	...	...	...	*
pseudo-diadema	Lamarck	...	...	...	...	*
Pedina rotata	Agassiz	*	...	...	...	...
Echinus perlatus	Desmarest	*	*	...	...	*
serialis	Agassiz	*	*	...	...	...
granularis	Wright	*	...	...	...	...
gyratus	Agassiz	...	...	...	...	*
Arbacia Forbesii	Wright	*	...	...	...	...
nodulosa	Wright	...	*	...	...	...
Cassidulidæ.						
Pygaster semisulcatus?	Phillips	*	*	...	...	*?
conoideus	Wright	*	...	...	...	...
Morrisii	Wright	...	*	*	...	...
Holectypus depressus	Lamarck	*	*	*	...	*
hemisphæricus	Desor	*	...	...	...	...
Hyboclypus agariciformis	Forbes	*	...	...	...	...
caudatus	Wright	*	*	...	...	...
gibberulus	Agassiz	*	...	...	...	...
Dysaster ringens	Agassiz	*	...	*?	...	...
bicordatus	Desor	*	...	...	...	...
ovalis	Parkinson	...	...	...	*	*
analis	Agassiz	*	...	...	...	...
Nucleolites clunicularis	Llhywd	*	*	*	...	...
dimidiatus	Phillips	...	..	...	...	*
Hugii	Agassiz	*	...	...	...	...
orbicularis	Phillips	*	*	*	...	...
Solodurinus	Agassiz	*	...	...	...	...
sinuatus	Leske	*	*	*	...	*
Agassizii	Wright	*	...	...	...	...
emarginatus	Phillips	...	...	...	...	*
Pygurus pentagonalis	Wright	*	...	...	...	*
Blumenbachii	Koch and Dunker	*?	...	...	...	*

XXVII.—*Notices of British Fungi.* By the Rev. M. J. Berkeley, M.A., F.L.S., and C. E. Broome, Esq.

[Continued from p. 189. vol. vii. Ser. 2.]

[With four Plates.]

615. *Sphæria* (Circinatæ) *hapalocystis,* n. s. Sparsa tecta; peritheciis subglobosis tenuibus subtiliter tomentosis, collo obliquo deorsum constricto una cum ostiolo breviter fusiformi; sporidiis oblongo-ellipticis utrinque appendiculatis biseptatis. On dead twigs of plane, Batheaston.

This species, which is just intermediate between *Obtectæ* and *Circinatæ,* is closely allied to *S. aucta,* but differs in the nature of the spores, which are broader in proportion, especially when old, and are essentially biseptate, whereas in *S. aucta* they are uniseptate or triseptate from the division of the two original endochromes. In both there is the same peculiar truncate hyaline appendage. The perithecia are peculiarly delicate. There is some resemblance also to *S. vestita,* but the perithecia are more decidedly tomentose in that species.

Plate X. fig. 12. *a.* Cluster of perithecia from which the cuticle has been removed; *b.* single perithecium; *c.* portion of its delicate wall; *d.* ascus; *e.* sporidia; *f.* do. germinating. All more or less magnified.

616. *S.* (Seriatæ) *lineolata,* Roberge; Desm.! Pl. Crypt. no. 1263. "Amphigena erumpens; stromate brunneo. Peritheciis minutissimis astomis nigris albo-farctis subconnatis in seriem simplicem dispositis. Ascis clavatis; sporidiis oblongis; sporulis 3–5 globosis." On *Ammophila arundinacea.* Sands of Barrie, Mr. W. Gardiner, with *S. sabuletorum.*

617. *S.* (Byssisedæ) *Dickiei,* n. s. Peritheciis aggregatis erumpentibus subglobosis ostiolo obtuso papillæformi setis rigidis longiusculis obsitis; filamentis thallinis intertextis. *Lasiobotrys Linnææ,* Dickie, MSS. On leaves of *Linnæa borealis,* Aberdeen, Dr. Dickie, 1845; Glen Dole, Clova, Rev. W. A. Leighton, Aug. 1837; Inglesmaldie, Kincardineshire, G. Lawson, Esq., 1848.

Forming orbicular sori beneath the true cuticle about a line broad. Perithecia at length exposed, subglobose, with an obtuse papillæform ostiolum beset with stiff dark bristles as long or longer than themselves, springing from a radiating more or less interwoven stratum of very obscurely septate brownish threads, amongst which are a few darker and closely articulate. Asci short, subcylindrical, obtuse; sporidia oblong, short, containing about four nuclei or four regular endochromes, or more properly uniseptate with two endochromes in each division.

This has precisely the habit of *Lasiobotrys,* and occurring on

a plant of the same natural order, at first sight seems to claim a place in that genus, but it has not the very peculiar structure to which we shall advert towards the end of our memoir. Should the large Sclerotioid bodies in that genus hereafter prove to be ascigerous, it will then be time to consider the propriety of associating the two species.

PLATE X. fig. 8*. *a.* Perithecium; *b.* subiculum; *c.* asci; *d.* sporidia. All more or less magnified.

618. *S.* (Byssisedæ) *Desmazierii,* n. s. Subiculo latissime effuso tomentoso; peritheciis magnis insidentibus globosis hic illic confluentibus scabriusculis ostiolo papillæformi; ascis elongatis; sporidiis elongato-cymbiformibus 6–7 nucleatis fuscis. On the ground in woods. First found, in company with M. Desmazières, in the beginning of August, and still very abundant, at the end of October 1851, Collyweston, Norths.

Spreading widely over the ground, fallen leaves, &c., and covering them with a mouse-coloured tomentose subiculum, which consists of somewhat branched anastomosing threads, the tips of which give off opposite, often subdivided branchlets, which form little racemes, surmounted by oblong conidia. Perithecia large, half immersed in the subiculum, which in age acquires a darker hue, somewhat scabrous, dull pitchy black, or plumbaginous, globose, with a central papillæform ostiolum, which is frequently seated in a little irregular areola. Asci elongated, clavate, inner membrane furnished with an oblong process at the tip; sporidia large, cymbiform, elongated, subacuminate, at first hyaline, with two or three variously-sized globules, at length dark brown, containing six to seven globose nuclei.

This magnificent species resembles closely *Sphæria aquila,* Fr., but the colour of the subiculum is different, as is also the habitat, but above all, the sporidia, which instead of being subelliptic and short as in that species and *S. fusca,* are much elongated and very peculiar in form.

We have dedicated this magnificent species to M. Desmazières, as one of the results of his short visit to England during the past summer. The species to which this name was given without any characters is now rejected both by Fries and M. Desmazières as imperfectly known. A notice of it will be found in the Gardeners' Chronicle for 1851.

PLATE IX. fig. 1. *a.* Subiculum; *b.* ascus; *c.* sporidia in various stages of growth. All more or less magnified.

**S. tristis,* Tode, vol. ii. p. 9. t. 9. f. 67. We have just received the true species from the Rev. A. Bloxam, which is characterized by the collapsing perithecia and minute oblong curved

biseptate or trinucleate sporidia, whereas the sporidia of *S. phæostroma,* Mont., are exactly as described in the 'English Flora' under *S. tristis β.*

619. *S.* (Villosæ) *macrotricha,* n. s. Subiculo repente; peritheciis ovatis deorsum pilis longis vestitis, sursum attenuatis denudatis, cum ostiolo papillæformi collabentibus; ascis clavatis; sporidiis fusiformibus uniseptatis, 6-nucleatis. On dead leaves of *Carex paniculata,* Batheaston, Feb. 1851. On beech mast, King's Cliffe, Oct. 1851.

Brown or nearly black; subiculum effused, consisting of interwoven creeping hairs; perithecia crowded, ovate, clothed with long hairs, attenuated and more or less denuded above, and when dry collapsing with their papillæform ostiolum. Asci clavate. Sporidia biseriate, fusiform, consisting of two apposed cones constricted at the juncture and sometimes above the first nucleus, each division containing one or more globules.

This species appears to us very distinct from all described by authors. It seems to come nearest to *S. crinita,* Fr., but his published specimens are *Chætomium elatum,* Kze.

The Cliffe specimens are darker, and the hairs are shorter, but the form of the perithecia, their papillæform collapsing, comparatively naked apex, and above all the sporidia, are identical.

Plate IX. fig. 2. *a.* Perithecium; *b.* ostiolum; *c.* thread of mycelium; *d.* fragment of perithecium with flocci; *e.* ascus; *f.* sporidia. All more or less magnified.

620. *S.* (Villosæ) *chætomium,* Corda! Ic. Fasc. 2. t.13. fig.102. *Chætomium pusillum,* Fries! Sc. Suec. no. 272. *S. exosporioides,* Desm.! Pl. Crypt. no. 126. On dead leaves of *Carex pendula,* Batheaston, with *S. Eres.*

There is no essential difference between the plant of Fries and Desmazières. Corda's figure represents the hairs as broad as the base and incurved, but we find them exactly as in *S. exosporioides,* Desm. The asci and sporidia agree in all the specimens, except perhaps that in the specimens of Fries the asci are slightly more slender and the endochromes less marked, differences which occur in many species under varying circumstances of age, &c.

We subjoin the characters of *S. exosporioides* as given in the 'Plantes Cryptogames de France':—

"Hypo- rarius epiphylla. Peritheciis minutissimis superficialibus sparsis vel gregariis humectatis subglobosis; siccis pezizoideo-collapsis atris; pilis concoloribus rigido-divergentibus obsitis; ostiolis papillatis exilissimis; ascis subfusiformibus; sporidiis oblongis, rectis vel subcurvatis; sporulis 4 opacis."

Plate IX. fig. 3. *a.* Perithecium; *b.* flocci; *c.* asci; *d.* sporidia. All more or less magnified.

621. *S.* (Villosæ) *Eres*, n. s. Sparsa superficialis; peritheciis globosis pilis longis rigidis articulatis vestitis; ascis brevibus clavatis; sporidiis oblongis uniseptatis. On dead leaves of *Carex paniculata*, Spye Park, Feb. 1850; on *Carex pendula*, Batheaston, Jan. 1850.

Scattered over the leaves and quite superficial, attached by a few hyaline creeping threads. Perithecia globose, beset with very long radiating, rigid, somewhat pellucid articulated bristles, which are black to the naked eye, but purplish brown under the microscope; when young their apices are often swollen. Asci rather short, clavate; sporidia biseriate, oblong-elliptic, about four times as long as broad.

This very beautiful species occurs on the same leaves as the foregoing, and is distinguished by its much larger perithecia, longer pellucid not opake hairs, clavate not fusiform asci, and shorter uniseptate sporidia. The present under a lens looks very like *Vermicularia trichella*; whereas the hairs of the former are scarcely visible.

Plate IX. fig. 4. *a.* Perithecium; *b.* one of the flocci; *c.* ascus with paraphyses; *d.* sporidia. All more or less magnified.

622. *S.* (Denudatæ) *arenula*, n. s. Sparsa ochroleuca peritheciis ovatis brevissime pedicellatis ostiolo papillæformi; ascis clavatis; sporidiis oblongis subfusiformibus uniseptatis. On dead leaves of *Aira cæspitosa*, Batheaston, Feb. 1851.

Thinly scattered over the leaves. Perithecia ovate, with an obtuse papillæform ostiolum, contracted at the base, rarely obovate and perfectly blunt. Asci subclavate; sporidia biseriate, oblong, slightly attenuated, rarely subelliptic uniseptate.

Allied to *S. coccinea*, and at first calling to mind our genus *Oomyces*, but agreeing really in structure with the above-mentioned species.

Plate IX. fig. 5. Asci and sporidia magnified.

**S. pulvis pyrius*, P. A very curious state of this species has been found at Rudloe in Nottinghamshire on broom, and specimens gathered by Capt. Carmichael in a similar condition are in Sir W. J. Hooker's herbarium. The perithecia are sometimes positively produced beneath the cuticle, but on the same twig others occur on the naked portions of the bark and run over the stroma of some *Sphæria*, probably *S. fusca*, so as to give it a very curious appearance, and to have led Dr. Klotzsch to consider the production as *S. conglobata*, Fr. The subcuticular specimens have the habit of *S. verrucaria*, which very frequently accompanies *S. conglobata*. A specimen of the latter sent to us by Fries has given us the opportunity of examining *S. verrucaria*, which we

find truly distinct from *S. epidermidis* in its very short flask-like asci and linear-oblong uniseptate sporidia, which however are scarcely mature, and may therefore be further divided at a later stage of growth.

623. *S.* (Obtectæ) *melanotes,* n. s. Maculis elongatis nigerrimis; peritheciis tectis, ostiolis minutis; ascis linearibus; sporidiis ellipticis fuscis. On oak palings, Batheaston, Dec. 1851.

Forming oblong, somewhat irregular black patches about an inch long, sprinkled with the punctiform ostiola. Perithecia immersed, scarcely visible except from their ostiola. Asci linear; sporidia elliptic, brown, $\frac{1}{2000}$th of an inch long.

This species has somewhat the habit of *S. livida,* but has smaller perithecia and different fruit. The black spots are scarcely at all raised. I find nothing like it in Fries. The perithecia do not raise the surface of the wood into little waves as in *Sphæria anserina,* which is described by Persoon as having the sporidia pointed at either end. *S. anserina* of the 'English Flora' is a *Sphæropsis.*

Plate IX. fig. 6. *a.* Asci magnified; *b.* sporidia on the same scale as those in fig. 7.

624. *S.* (Obtectæ) *hypotephra,* n. s. Maculis effusis cinereis; peritheciis tectis subglobosis; ostiolis obtusiusculis emergentibus; ascis linearibus; sporidiis elongatis curvulis demum 3-septatis. On oak rails, King's Cliffe, Nov. 1851.

Forming large cinereous spots. Perithecia covered, globose; ostiola rather obtuse, protruding. Asci linear; sporidia uniseriate, oblong, slightly curved, rather narrow, about $\frac{1}{1000}$th of an inch long; at length 3-septate, often binucleate. Allied to the last, but at once distinguished by the pale spots and differently shaped larger sporidia.

This somewhat resembles Persoon's *S. anserina,* but the sporidia are of a different form.

Plate IX. fig. 7. *a.* Ascus with sporidia; *b.* sporidia.

625. *S.* (Obtectæ) *siparia,* n. s. Tecta sparsa; peritheciis magnis depressis lanatis; ostiolo obtuso brevissimo; ascis clavatis amplis; sporis oblongo-cymbiformibus cellulosis muco involutis. On birch with *Prosthemium betulinum* and *Hendersonia polycystis,* Spye Park, Feb. 1850.

Scattered, covered by the cuticle. Perithecia large, depressed, furnished with a very short central ostiolum, clothed with more or less dense ferruginous wool. Asci large, clavate; sporidia biseriate, oblongo-subcymbiform, cellular, clothed with a mucous coat.

This magnificent species, which is allied to *S. lanata,* in which

the sporidia are minute and curved, is remarkable for the beauty of its fruit, which resembles in colour and structure that of *S. herbarum.*

PLATE IX. fig. 8. *a.* Asci; *b.* sporidia highly magnified in various stages of development.

626. *S.* (Subtectæ) *Argus,* n. s. Tecta; peritheciis magnis depressis collapsis opacis; ascis amplis clavatis; sporidiis octonis biseriatis oblongis curvulis ocellatis serius 5–6 septatis, muco involutis. On dry birch twigs, Spye Park, with *Hendersonia polycystis* and *Sph. lanciformis.*

Entirely concealed by the cuticle, scattered. Perithecia depressed, collapsed, dull, as if very minutely pulverulent; ostiolum minute. Asci clavate, large. Sporidia biseriate, oblong, slightly curved when seen laterally, at first consisting of two joints; these soon acquire seven endochromes, of which four belong to the larger division, in which state they resemble *Sirosiphon ocellatum*; at a later period they become much darker, and true septa are formed varying in number from five to six. Till they acquire this dark tint, they have a thick pellucid gelatinous coat.

Few microscopic objects can be more beautiful than the fruit of this and its two associates. In *S. lanciformis* the endochromes are connected by a little process exactly as in *Sirosiphon*; in the present species the resemblance is more superficial, but sufficiently strong to suggest the specific name. *S. amblyospora* is at once distinguished by the peculiar form of its sporidia.

PLATE IX. fig. 9. *a.* Perithecium; *b.* sporidia more or less magnified.

627. *S.* (Obtectæ) *amblyospora,* n. s. Sparsa tecta; peritheciis depresso-globosis; ostiolo papillæformi; ascis amplis; sporidiis fuscis obovatis 2–3 septatis muco involutis. On dead branches of elm, at Clifton and elsewhere.

Scattered, scarcely visible externally. Perithecia immersed in the bark, depresso-globose, with a central papillæform ostiolum without any neck. Asci large, clavate, paraphyses flexuous; sporidia large, at first hyaline, consisting of two subconical articulations placed base to base; one of these gradually increases in diameter and becomes very obtuse; a septum is then formed at the base of the smaller articulation, and sometimes, though rarely, there is a third septum in the other cells. In every stage, except in extreme age when ejected, they have a gelatinous coat.

This is one of the finest species of the group, and distinguished from *S. inquinans* by the peculiar form of its sporidia, and more especially in the mode of their formation, for here and there an individual sporidium is observable which is equal at either extre-

mity. In germination, the lower articulation sends out a filament either laterally or from the extremity.

PLATE X. fig. 10. *a.* Ascus with paraphysis; *b.* sporidia in various stages of growth; *c.* ejected sporidia germinating. All more or less magnified.

628. *S.* (Obtectæ) *aucta*, n. s. Sparsa tecta; peritheciis globosis collapsis subtiliter tomentosis; collo obliquo deorsum constricto cum ostiolo breviter fusiformi; ascis amplis; sporidiis oblongo-ellipticis utrinque appendiculatis uni–3-septatis. On dead twigs of birch and alder, Spye Park, Wilts.

Scattered, scarcely visible externally except from the swelling of the bark above the perithecia. Perithecia globose, obscurely tomentose, soon collapsed; neck oblique, constricted below, confluent with the shortly spindle-shaped ostiolum. Asci broad, delicate; sporidia elliptic, with a truncate process at either extremity; at first uniseptate, with an endochrome of the same form as the cells; this eventually is divided into two nuclei, between which a new septum is formed, so that the sporidia have either one or three septa, in which latter case there is a constriction at each articulation.

PLATE X. fig. 11. *a.* Ascus; *b.* sporidia. More or less magnified.

629. *S.* (Obtectæ) *bufonia*, n. s. Sparsa; peritheciis globoso-depressiusculis, ostiolo brevi corticem perforante; ascis cylindricis; sporidiis uniserialibus oblongis uniseptatis muco involutis. On small dead branches of oak, Easton, Northamptonshire.

Scattered over the branches, which are rough with the little penetrating ostiola. Perithecia globose, slightly depressed; ostiolum central, papillæform, with scarcely any neck. Asci cylindrical, containing a single row of oblong uniseptate sporidia which have a thick gelatinous coat which ultimately vanishes. The strings of sporidia remind one somewhat of toad spawn.

PLATE X. fig. 13. *a.* Ascus; *b.* spores contained in inner membrane of ascus; *c.* spores which have lost their gelatinous coat. More or less magnified.

630. *S.* (Obtectæ) *dochmia*, n. s. Sparsa tecta; peritheciis solitariis ovatis obliquis demum collapsis; collo brevissimo constricto ostiolo explanato. On dead twigs of elm, Batheaston, Jan. 1851.

Scattered over the twigs, but visible externally, merely from the swellings caused by the perithecia. Perithecia somewhat ovate, oblique, collapsed when dry; neck extremely short and somewhat constricted; ostiolum broad, obtuse, perforated in the centre. Asci cylindrico-clavate, obtuse; sporidia oblong, very obtuse, slightly curved, at length uniseptate, hyaline, arranged in two rows.

Distinguished by marked characters both in the perithecia and sporidia from all allied species.

Plate X. fig. 14. *a.* Perithecium; *b.* ascus; *c.* sporidia. More or less magnified.

631. *S.* (Obtectæ) *farcta,* n. s. Tecta dispersa; peritheciis solitariis globosis demum collapsis collo brevi, ostiolo obtuso demum epidermidem perforante; ascis clavatis obtusis sporidiis oblongis utrinque obtusiusculis 3–4 nucleatis repletis. On dead twigs of elm, Batheaston, Jan. 1851.

Scattered, scarcely conspicuous externally except from the slight projection over each perithecium, which is at length perforated by the obtuse ostiolum. Perithecia globose, collapsing when dry; neck short. Asci clavate, subcylindrical, obtuse, filled with numerous oblong linear sporidia, which are slightly obtuse at either end, and contain three or more globose nuclei.

This species resembles externally *S. hypodermia,* but the perithecia are solitary and the sporidia very different. The nearest ally perhaps is *S. Lebiseyi,* Desm., which is however much smaller, and has apiculate but otherwise similarly-shaped sporidia. In *Sphæria ditopa* as found on alder by Dr. Roussel, for Fries' specimen shows no fruit, the asci are stuffed, but the sporidia are larger and uniseptate. *Sph. ditopa,* Rab. no. 1038, is a very different species, with very elongated, curved, obtuse sporidia. It seems rather to belong to *Circinatæ,* and may be characterized—

S. Rabenhorstii, n. s. Peritheciis depressis ostiolis rectis; ascis amplis clavatis; sporidiis octonis elongatis utrinque obtusis majoribus curvulis.

Plate X. fig. 15. *Sph. farcta*: *a.* Ascus; *b.* sporidia. More or less magnified. Fig. 15*. *S. ditopa*: *a.* Ascus; *b.* sporidia. Both magnified.

632. *S.* (Obtectæ) *trivialis,* n. s. Sparsa, tecta; peritheciis depressis minutis, ostiolo obsoleto; ascis amplis clavatis obtusis; sporidiis ellipticis uniseptatis. On dead twigs, Batheaston, Feb. 1851.

Scattered, covered by the cuticle, which appears brownish over each perithecium, but is really colourless. Perithecia depressed, elliptic; ostiolum obsolete; asci broad, clavate, containing eight broadly elliptic uniseptate sporidia.

Resembling somewhat as to the fruit ascigerous *Sphæria mutila,* but truly belonging to the section *Obtectæ.*

Plate X. fig. 16. Ascus filled with sporidia. Magnified.

633. *Sphæria tomicum,* Lév. Ann. d. Sc. Nat. 1848.
Var. minor.
On *Aira cæspitosa,* Batheaston, Jan. 1850.

Our plant agrees with that of Léveillé in external appearance and in the spores, but differs simply in being far smaller, a circumstance probably attributable to its growing on the thin leaves of a grass instead of the juicy stems of a large *Juncus*.

We have also the same thing on dry withered stems of *Juncus conglomeratus* gathered at Draycott, Wilts, in which the sporidia are sometimes but not always more elongated, though essentially the same in colour and form.

We have placed the species here rather than in *Caulicolæ*, on account of its near relation to *S. clypeata*.

Plate XI. fig. 17. *a.* Ascus; *b.* sporidia. More or less magnified.

634. *S.* (Obtectæ) *revelata*, n. s. Tecta, globosa, major, ostiolis brevibus papillæformibus sero expositis; ascis linearibus flexuosis; sporidiis uniserialibus oblongis biseptatis. On branches of lilac, Apethorpe, Jan. 1848.

At first completely concealed beneath the rough bark, and at length only manifest from the ostiola thrusting off little patches of the matrix, and then appearing solitary or scattered on white spots. Perithecia globose, large; ostiolum papillæform, distinct. Asci linear, flexuous; paraphyses long, slender; sporidia uniseriate, oblong, hyaline, biseptate, with very distinct endochromes.

We have a form of this species on twigs of elder gathered at Apethorpe, Nov. 1840, in which the ostiola are conical and much more developed, and the perithecia smaller. The asci and sporidia agree perfectly.

Another form occurs on *Chionanthus virginica*, and something very similar on lilac has been gathered by Dr. Léveillé at Romainville.

Plate XI. fig. 18. *a.* Ascus and paraphysis; *b.* sporidia. More or less magnified.

635. *S.* (Obtectæ) *conformis*, n. s. Tecta sparsa; peritheciis nigris globosis demum collapsis ostiolo papillæformi; ascis subclavatis; sporidiis biserialibus oblongo-ellipticis utrinque obtusis biseptatis. On dead twigs of alder, mixed with *S. ditopa*.

Resembling closely *S. ditopa*, but differing in the small number of sporidia contained in each ascus, which are also broader and more obtuse, and exactly resembling those of *S. fuscella*.

Plate XI. fig. 19. *a.* Ascus; *b.* sporidia in various stages of growth. All more or less magnified.

636. *S.* (Obtectæ) *fuscella*, n. s. Sparsa tecta; peritheciis fuscis depressis; ascis linearibus obtusis; sporidiis uniserialibus oblongo-ellipticis quandoque curvulis triseptatis. On dead twigs of rose, Easton, Norths., March 9, 1850.

Scattered, forming minute pustules; perithecia depressed, subglobose, brown. Asci linear, containing eight sporidia arranged in a single row; sporidia pale brown, oblong-elliptic, obtuse, triseptate, by no means constricted at the articulation, sometimes slightly curved.

Distinguished from *S. sepincola* by its minute brown perithecia and even elliptic obtuse sporidia. There is no sign of any ostiolum externally, nor have we ascertained the existence of any. *S. Corni*, Sow., which is usually referred to *S. sepincola*, has curved simple reproductive bodies apparently without asci. At least, such is the case with the specimens still remaining in Sowerby's Herbarium.

S. sepincola according to our notion of the species has slender, somewhat clavate asci and biseriate, oblong, subfusiform hyaline sporidia. Specimens may be found with slightly varying characters as to size and figure, but it is best to consider all which agree in essential respects as forms of one species. We therefore now refer the minute *Sphæria* found on dock-stems by Mr. Gardiner at Balmerino, formerly named *S. Gardineri*, to *S. sepincola* as a minute form on herbaceous stems.

Plate XI. fig. 20. *Sphæria fuscella*: *a*. Ascus; *b*. sporidia more or less magnified, but less so than in *S. conformis*. Fig. 21. *S. sepincola*: *a*. Ascus; *b*. sporidia: both magnified.

637. *S.* (Obtectæ) *persistens*, n. s. Sparsa ligno adnata demum cortice putrescente nuda subglobosa ostiolo parvo distincto; ascis clavatis, sporidiis biseriatis hyalinis fusiformibus centro constrictis curvulis sporidiolis quaternis. On dead shoots of rose, Bedford Purlieus, King's Cliffe, March 1850.

Scattered over the branches, and so immersed in the bark as not to form any pustules, exposed and persistent when the matrix is decayed, globose with a minute distinct ostiolum. Asci clavate, containing two rows of sporidia. Sporidia hyaline, fusiform, straight when seen from behind, slightly curved when seen laterally, constricted in the centre, each division containing two globose sporidiola. Well distinguished by its persistent nature and curious sporidia. We have not observed any septa.

Plate XI. fig. 22. *a*. Ascus and paraphysis; *b*. sporidia. All more or less magnified.

638. *S.* (Obtectæ) *futilis*, n. s. Sparsa epidermide nigrifacta tecta; peritheciis subglobosis; ascis linearibus; sporidiis uniseriatis brevibus oblongo-ellipticis uniseptatis. On dead rose-twigs, King's Cliffe, March 1850.

Minute, scattered, covered by the blackened cuticle so as to present little black specks. Asci linear; sporidia uniseriate,

short, oblong-elliptic, hyaline, sometimes slightly constricted in the centre, uniseptate. The septum appears to be continued through the external as well as the internal membrane.

The sporidia have much the form which is so common in the genus *Diplodia.* We can find no trace of the species in authors.

PLATE XI. fig. 23. *a.* Asci and sporidia; *b.* sporidia more highly magnified.

639. *S.* (Subtectæ) *intermixta,* n. s. Minutissima sparsa epidermide tantum tecta nigra; peritheciis depressis supra convexis perforatis; ascis clavatis; sporidiis biseriatis hyalinis clavato-fusiformibus triseptatis. On rose-twigs mixed with *Sphæria fuscella,* but much smaller.

Scattered, seated beneath the cuticle. Perithecia very minute, convex, depressed, perforated in the centre, black. Asci clavate; sporidia biseriate, hyaline, clavato-fusiform, triseptate. One of many undescribed species comprised by authors under the name of *S. Epidermidis.* The asci are large for the size of the perithecia.

PLATE XI. fig. 24. *a.* Asci; *b.* sporidia: both magnified.

**S. Epidermidis,* Fr. Scler. Suec. no. 19. In two copies of the 'Scleromycetes Suecicæ,' which we have the opportunity of examining, three things at least appear under this name, all marked no. 19:—1. A *Sphæria* on elder, which appears from its long sporidia to be a state of *S. sepincola,* or possibly of *S. Lebiseyi*; 2. another on elder, which we consider the type of the species with uniseptate sporidia, consisting of two apposed, rather irregular cones; and 3. a production on some Lonicera, which appears to be the same with a minute *Phoma,* common in this country on the same matrix. It appears in this case, as in *Sphæria sepincola,* the best course to consider species agreeing in structure, though differing somewhat in size, as mere forms of one type. We refer therefore to this species, one which we find on privet with very superficial, but rather thick and brittle perithecia, and sporidia twice as large and more constricted at the septum and in the centre of the two cones which compose them. It occurs on the same twigs with *Tympanis saligna,* which when young resembles closely a sub-cuticular *Sphæria* with a broad truncate ostiolum.

**S. Buxi,* Desm. Pl. Crypt. no. 1280. *S. atrovirens* b. Buxi, junior, Berk. Br. Fung. no. 180, pro parte.

Common on box leaves, on which several productions grow; comprised in Fries' 'Systema' under the name of *S. atrovirens.* In the present species the sporidia are short, oblongo-elliptic, hyaline, biseriate, slightly attenuated at either extremity.

**S. Rusci,* Wallr. Comp. Fl. Germ. p. 776. *S. atrovirens* δ. Rusci, Eng. Fl. vol. v. pt. 2. p. 272; Desm. 1281.

Common on leaves of *Ruscus aculeatus,* as at Wareham, from whence it has been sent by the Rev. W. Smith. Asci lineari-clavate; sporidia biseriate, oblong, obtuse, 4–5-septate.

**S. derasa* = *S. calva,* Johnst. Fl. Berw. Perfect specimens of *S. calva,* Johnst.†, have lately been received from Mr. Bloxam. The asci are clavate; the sporidia biseriate, fusiformi-filiform, slightly curved, filled with a row of nuclei, at length faintly septate. One of the articulations is sometimes swollen. Specimens exactly agreeing with *S. comata,* Tode, have been sent from South Carolina by Mr. Ravenel, which have oblong multiseptate sporidia, with one or more vertical septa occasionally as in *S. herbarum*; we have therefore no hesitation in considering Dr. Johnston's plant as a distinct species.

Plate XI. fig. 25. *a.* Sporidia of *S. comata* from South Carolina; *b.* sporidia of *S. derasa.* Both highly magnified.

**S. acuminata,* Sow.! t. 394. f. 3 = *S. Carduorum,* Wallr. Comp. Fl. Germ. vol. iv. p. 805; Desm. Ann. d. Sc. Nat. 2 sér. vol. xvii. p. 106. Common on dead thistle stems.

The spores in this species are linear, and contain at first numerous nuclei without articulations; at a later period of growth, however, the articulations are very manifest, aud we doubt not that *S. acuminata,* Sow.! is in truth the perfect form of Wallroth's species. In *S. coniformis,* the fructification of which is figured by Greville as that of *S. herbarum,* to which species therefore *S. acuminata* was referred in the 'English Flora' as agreeing to a certain extent in the sporidia, the number of joints is about half as great as in the present species. In *S. coniformis* there are about eleven joints, in *S. acuminata* about twenty. The sporidia, whether young or old, have a swelling near the apex, which is at the second articulation in the perfect sporidium.

Plate XI. fig. 26. *a.* Sporophores; *b.* spores *in situ.* Both magnified.

**S. Arundinis,* Fr. Syst. Myc. p. 510, var. *Tritici.* On wheat-straw, King's Cliffe, May 1, 1843.

Differing in no respect from the typical form, except in size.

† Dr. Johnston found also at Berwick, on *Senecio Jacobæa,* a fine species of *Phlyctæna,* which, as the genus is new to this country, we take this opportunity of characterizing :—

Phlyctæna Johnstoni, n. s. Maculis latioribus; pseudo-peritheciis brunneis; sporophoris flexuosis amplis, sporis elongatis curvis, medio nodulosis.

The spores are several times longer than in the original species, the sporophores highly developed, and towards the centre of the spores there is generally a distinct knot, and frequently the outline is more or less irregular.

In both the spores are at first uniseptate, and the contents of the two portions are then divided into two or three endochromes, in which respect there is an essential difference between this species and all forms of *S. culmifraga*.

[To be continued.]

XXVIII.—*Rambles in Ceylon.* By E. L. Layard.

Mulletivoe, April 7, 1851.

My Dear Sir,—I promised to keep you informed of my wanderings between Jaffna and Kandy; so here you have the first instalment. Knowing your taste for my favourite pursuit, I have thrown in a few notes thereon, the results of observations made at various times, which have recurred to me, as the discovery of a new species, or a new trait of character in an old one, have brought them to my remembrance.

I left Jaffna in the royal mail on the 31st March, having sent off my baggage in a bullock bandy, to the back of which was attached a light gig, in which I proposed to drive down the great central road to Kandy, a distance of 184 miles through the jungle, and a feat hitherto unaccomplished since the road was opened.

Many were the prophecies of my failure. Mr. B., our civil engineer, left me in the lurch on the banks of the Pie or Sitt-aars, two rivers which I should have to cross. Mr. D., whose brother-in-law was to accompany me, broke me down between Damboul and Nalandy, at a rocky part of the road. Mr. D., our government agent, stuck me up to the middle in mud between Nalandy and Matelle. One person only encouraged me,—that was Mr. Q., who had surveyed and cut the road and was going with me to Mulletivoe. But to return: I started at 2 p.m. in the mail for Karandi, Mr. D.'s cocoa-nut estate; and oh! what a royal mail! The smart English vehicle of that name and its four dashing horses was represented by an old palanquin carriage (which you must know is like a palqui stuck on wheels, having a well cut in the bottom to contain one's feet), and a sorry broken-winded, broken-kneed horse. The substitute for a coachman consisted in a nigger in undress, that is, with a thin slip of cloth drawn between his legs, and fastened before and behind to a string tied round his loins, who tugged at the horse's mouth; while the mail-guard or conductor sat inside with me, the letters being deposited in his coat-pockets; a gridiron and tea-kettle belonging to myself, swinging in front, complete the picture of the "royal mail." After being relieved every five miles by a fresh horse, *worse* if possible than the former, we reached our destination,—a cadjan shed at the end of the macadamized road, and the beginning of the European estates. Here I found a horse awaiting me, and after a dark and tiresome ride of eight miles through sand up to the horse's fetlocks, my nag came to halt at a gate. Concluding this to be the estate, I turned in, and was soon welcomed by D., his wife, and her brother Mr. B. of the Madras service. After discussing our plans over the dinner-table,

D. and B. went to set alligator-hooks in the little tank opposite the house, and we then separated for the night. By daylight next morning we were afoot again, and after the usual cup of coffee, we three gentlemen adjourned to the tank with our guns. Out of six hooks set, five were taken; two floated in the centre of the tank, the others had been dragged off into the jungle. Two of the natives waded in and got hold of the floats (the hooks to which we found had been taken by one alligator), and hauled them ashore. As the reptile came to the grassy margin snapping his jaws, I fired a ball, 120 to the lb., down his throat; D. fired another weighing an ounce slantingly through him, entering just behind the right shoulder; B. fired a second in the contrary direction; both balls went through him; and I gave him a final salute, with a 60 to the lb. rifle, between the eyes: still he appeared not to mind it, and bit furiously at everything. Several heavy blows were then struck on his head: as he was impervious to our boar-spears, and he lay as we thought dead, with his mouth open, B. incautiously put his gun-stock into his mouth, when with a snap he closed his formidable teeth on the hard wood, indenting it most deeply.

Alligators are cowardly brutes on land; even in their more genial element, when hooked they give no "play," as a salmon-fisher would term it, but suffer themselves to be dragged tamely on shore and die anything but game. It is said there are two species in the island; one, called by the Cingalese *Minikana-Kimboola,* by the Tamuls *Sammooken,* has been thus described to me:—Throat and belly white, nose red, back and tail dark green; it grows to the length of 18 or 20 feet, and inhabits rivers, and the salt lake at Batticaloa. This is the species that attacks men. The other and smaller kind, called *Hale-kimboola* by the Cingalese, and *Komodalle* by the Tamuls, only resides in tanks, and never attacks people: this species Dr. Templeton had never seen; the former, *in epistola,* he terms *C. biporcatus*: not having means at my disposal, I cannot identify them. The cervical plates of the smaller species are placed thus: counting from the head, the first row has four large plates, in pairs; second row, six small ditto, in triplets; third row four, as in No. 2, but equidistant; fourth row two very large.

Many instances are on record of the larger species carrying off human victims; one occurred many years ago at Matura, in the south of the island. My father, when residing there, had a bungalow on the banks of the river in which he was accustomed to dine. A party assembled there one day for tiffin were startled by loud cries from the water. My father remarked carelessly, for the benefit of some *Griffins,* "Oh! it's only a black fellow taken off by an alligator," when to the horror of all, the *Appoo* (head servant) rushed in exclaiming, "Master, cook carried away by one alligator." Nets were immediately procured, the river fished, and a huge alligator captured, which on being opened was found to have two *right* hands in his intestines. I often when a boy heard my father repeat this story; and a year or two ago, when on circuit with the Supreme court at Matura, I lived close to the spot. My wife took her chair and sat on the

river's banks enjoying the shade and cool breeze, not far from the place where the tiffin was so abruptly terminated. An aged Modliar, who owed his first preferment to my father, happening to pay me a visit, saw my wife sitting, and rushing up to her, he forcibly dragged her away, saying, "For God's sake, ma'm, don't go there; only three days since a large dog was taken off by an alligator from thence, and forty years ago your father's cook was seized on that very spot," and he then related the tale again.

The next instance I shall mention happened in the river at Chilaw. One of the Court Peons had been entrusted with despatches to convey to the lappal in the village across the river. He forgot his errand till the evening, when he went down to the river's brink with a companion and hailed the ferry-boat; the boatmen were, however, away, and fearing to loose the lappal hour, and having to brave the judge's wrath, the man determined on swimming across; so tying the letters in his turban he plunged into the sluggish waters. When about half-way over, his companion saw at some distance a dark body, that they had taken for a floating log, begin to move rapidly towards them, and instantly detected the dreaded Minikimboola: alarmed by his friend's shouts, the swimmer plied his strokes lustily and had almost gained the opposite shore, when with a yell of agony and despair he disappeared amidst the eddies of the water caused by the monster's sweeping tail. This brute was subsequently captured, and his head now adorns the district judge's quarters, where I saw it, and if I remember right, it is not much under two feet long. It is said that a small lump of chunamb (quick lime) placed in an alligator's mouth instantly destroys him. I have tried it on young ones, but never found it have the least effect. During the hot weather, when the tanks dry up, those alligators that cannot reach the sea, bury themselves in the mud. About Jaffna, however, they betake themselves to the estuary and live exclusively in the salt water, till their old haunts become wet enough for them. It is usually supposed that lead flattens on their scales; this I have found not to be the case. I have killed several with a single ball which has passed *completely through them,* and from the experiments we made on the body of one of our victims, we found that my little rifle-balls, 60 to the lb. and of the softest lead, penetrated every place with facility. On tracing our missing hooks, we found the alligators had jammed the ends of the floats in the tangled brushwood, and torn out the hooks from their entrails.

Under D.'s hospitable roof I spent two days and a half, waiting for my travelling companion Q. who was to join me at Elephant Pass. Time flew with us, as D. and his wife had tastes congenial to my own. Her paintings of the jungle flowers and fruits are beautifully and carefully executed. It is indeed a treat in Ceylon to meet with persons who can appreciate nature, or even *see* it, if they see it at all, with correct eyes. I have known ladies who had resided here for years, and daily drove through the Colombo Cinnamon Gardens, and yet never saw the *pitcher-plant,* which abounds there. Ladies and gentlemen *born* here, have gravely assured me that they have *seen*

the leaves and twigs of live plants turning into leaf-insects. "Ay," said one gentleman, "I have seen the legs growing day by day till it became just like a fly, but still with leaves for wings, and detach itself from the tree and walk about my table. Now you know I can't disbelieve my own eyes, though you do shake your head and smile." "Certainly not," I replied; "but please send for me when next you see the process."

On Wednesday the 3rd April, I rode over in the afternoon to Elephant Pass. The old fort which commands the ford serves as a rest-house. As I sat on the battlements, my eye wandered over the dark line of jungle across the water; through this jungle lay my course. How I revelled in the idea of penetrating its depths! What birds, insects and shells, unknown to me, lay there! Even from my lonely watch-tower, I could almost have struck, with the rifle resting beside me, pelicans, flamingoes, and several gigantic new cranes, as they floated or waded securely fishing, while I scanned them through my telescope. The night fell with its usual eastern rapidity over the glorious sunset which lighted the waters of the estuary, and still my fellow-traveller D. Q. had not come up. I had neither food, candle, or bedding; so comforting myself with a draught of brackish water, I threw myself down on the rough palmirah-log floor and fell asleep. At four next morning, a voice, speaking good English, brought me to my feet, and as my toilet had been made the night before, I was not long in admitting the stranger, a Portuguese, in charge of an estate in the neighbourhood. He told me that Mr. Q. was wind-bound at the mouth of the estuary for two days, but would be up at night; and that all my heavy traps, the *grub* included, were across the river at Timelamadam:—he himself had come up with the boats. Away then I started to wade over the ford, a good mile across. Our order of march was, first myself with my long collecting gun, known to my friends by the name of "Long Tom," which I consider worth describing to you, as a most invaluable weapon. Length of barrel 3 feet 7 inches; calibre rather less than $\frac{3}{8}$ths of an inch, carrying a ball 120 to the lb.; thickness of metal $\frac{1}{8}$th of an inch. The stock is fitted with a large trap, for holding caps, wadding, ball, needles and thread, &c. &c. The *full* charge for this gun is just one-fourth that of a sixteen gauge, or $\frac{1}{4}$ *of an ounce*: $\frac{1}{8}$th is a deadly charge for smallish birds at 30 yards; and for small birds (sparrows and such like) $\frac{1}{16}$th is sufficient at 20 yards. With two or three buck-shot, A A, it will kill any large bird at 150 yards, and throws its own ball with great precision: I have killed deer and pea-fowl with it at very long distances. The œconomy of this gun, when all the shooter's ammunition has to be carried by coolies, will strike any one. Following me was my Man Friday, alias Horse-keeper Muttu, with my rifle: this worthy is head gamekeeper, birdstuffer and skull-collector, and when at home head-nurse; he is indeed a black "pearl," as his name implies. Then came Cingalese appoo with large double gun. My horse followed at random, keeping close to his groom; while coolies with baggage and the bullock bandy with the gig brought up the rear. At day-break we made the opposite shore, and after a brisk canter of a couple

of miles, reached the madam, or rest-house, the portico of a heathen temple, and soon Pulliar's shrine was polluted by a smoking breakfast. While discussing this, I felt a cold nose thrust into my hand, and, behold! Q.'s big black dog "Ponto;" in a few moments Q. himself, rifle in hand, stood before me, bare-footed, with his shoes on his back! not having waited to put them on since crossing the ford! Breakfast was soon discussed, and after packing our bandies we sent them on to Condaville by the old road, while we went a new and shorter track, which Q. was to open. Occasionally dismounting to have a shot at the numerous hares and partridges with which this flat country and low jungle abounded, we reached Condaville, and after stabling our horses we turned out for a shot at a deer. We found them very wild, but managed to get a shot each, and both dropt our quarry, but owing to the darkness we failed in securing them; so they were left as a prey to the natives, who never fail to follow them up with their mute pariah dogs and almost invariably find them.

While threading our way homeward through the jungle, Q. suddenly sprang aside, and by the dim twilight I discerned a huge cobra coiled up ready for his spring: a charge from the little gun nearly cut him in half, to the great disgust of the natives, who blamed us for shooting a *high-caste snake*! A native will never kill a cobra; if he catches one about his premises, he will simply remove it to a distance and turn it loose. I know of one instance in which an old woman, finding one in her mat, seized it by the neck and flung it out of the room; the reptile returned infuriated, bit her, and she died. "Well," said her relatives, "it was her *fate*"!!!

The cobra is rather a sluggish snake; it inhabits old white ants' (Termites) nests, out of which it is often driven by the rains, when they may be frequently encountered in the jungle: it feeds principally on toads, which it captures in holes. I once watched one which had thrust its head through a narrow aperture and swallowed one. With this encumbrance he could not withdraw himself: finding this, he reluctantly disgorged the precious morsel, which began to move off; this was too much for snake-philosophy to bear, and the toad was again seized, and again, after violent efforts to escape, was the snake compelled to part with it. This time however a lesson had been learnt, and the toad was seized by one leg, withdrawn, and then swallowed in triumph. Once, and once only, have I seen a snake *chase* its prey: it was in a paddy-field, and the snake was the common species found in such situations; the frog dived and leaped and adopted all kinds of manœuvres to escape; the snake followed closely, rearing itself up to watch its quarry, and again pursuing it with all the keenness of a beagle. I stood perfectly still and watched this strange hunt for nearly an hour, and rejoiced to find that froggy baffled his enemy at last.

While discussing our dinner, Q. said, "You remember the man we saw this morning in the road, with the old musket?" "To be sure," said I. "Well," resumed Q., "that man is a most fearless elephant-hunter; I believe I gave him a taste for it in the following manner. I was opening the very road we came along tonight, and having

worked all day, I thought I'd go out in the cool of the evening and have a shot at an elephant, large numbers of which were hanging about and bothering me by pulling up my tracing-pegs. You've no notion, Layard, how they used to worry me in that way; a trace of a mile perhaps would be quite obliterated, every peg being pulled up and thrown away by the brutes. Well, as I was saying, I strolled out, followed by that very man: he had my heavy 2 oz. rifle, and I my little 'Joe Manton.' It was getting late, and as we crossed a little open glade, in the centre of which was a large white ants' nest crowned with bushes, out marched from the opposite side a huge elephant. I was then but a tyro at the gun, so dodging behind the ant-hill, we awaited his approach. On he came, flapping his huge ears, and evidently not seeing us. Taking the best aim I could in the darkness, I gave him the big rifle—the smoke hung in the bush, and ere I could get the little double 'Joe,' I felt myself violently dashed to the ground and the native on the top of me. Recovering my feet, I ran round the hill before the huge beast turned, which he quickly did, to look for his foes. I could see the blood streaming from both sides of his head; but before I could get a fair aim again, he tottered into the jungle, and as it was late I left him, determined to follow him up next day and give him the 'coup de grace.' Next morning, however, my quondam guide was nowhere to be found. I learnt afterwards he that night presented at the cutcherry the largest *tail* that had been seen for many a day, and got the government reward of 15*s*. He evidently found elephant-shooting a lucrative business, for he has since followed it unceasingly (in spite of having two guns burst in his hands), and kills a great many." "He'll not be long," I remarked, "before gun No. 3 bursts in his hands, and adds to the ugly scars he bears." "May be," said Q.; "that's his look-out." So saying he threw himself on his hammock, and following his example, I soon forgot elephants and cobras in slumber.

By five o'clock next morning we were afoot, and while Q. arranged his baggage for his six months' sojourn in the wilderness, I strolled out with my rifle and picked up a peacock. These birds are very partial to the stubble-fields, where they may always be found, morning and evening; during the heat of the day they conceal themselves in the densest trees they can find, as a shelter from the sun. They begin to lay in January, and generally bring out about ten young ones; the nest is made in long grass or paddy, and the eggs resemble the turkey's. After our breakfast we had a little rifle practice to fix our sights, and while doing this, I detected a fine *Sciurus macrourus* in a large tamarind-tree; he was soon brought down, stuffed by Man Friday, and duly installed as the first specimen procured. These squirrels are not uncommon in the northern province, and Q. says extend all the way to Anarajahpoora; I have traced them from Chilaw to Jaffna, along the western coast, so their range must be great. They however never, that I know of, intermingle with *Sc. Tennentii* (Nobis), which is strictly a hill species. This latter is a fine species, considerably larger than *S. macrourus*; it closely resembles *S. bicolor* of India. Mr. Blyth, who has carefully com-

pared it with that, writes, that it differs in having the caudal hairs, except at the extreme tip and base of the tail, much edged with white. It wants the black moustache and border under the eye, but has in lieu thereof a large triangular patch behind it, extending up to the ear, at the base of which is a rusty spot; the limbs are of a more fulvous white. *S. macrourus* (Forster) I had alive for some time. He was very tame and docile, and fond of being caressed. He would thrust his red nose through his cage-bars if any one passed him, and endeavour to attract his attention; if he failed in this, he would chatter vehemently, and his voice was peculiarly harsh and grating. His chief amusement consisted in climbing up one side of his cage, and throwing himself with a complete somersault to the other. His motions were very rapid, and he invariably carried his tail curled on one side; this I think he did to take care of it, for in the jungle the tail is carried straight.

We have five other *Sciuri* in Ceylon: *Sc. tristriatus* (Waterhouse), *Sc. Brodiei* (Blyth and Layard), *S. Layardi* (Blyth), *S. Kelaarti* (Layard), and *S. trilineatus* (Waterhouse); besides these there are two flying squirrels, *Pteromys oral* (Tickell) and *Sciuropterus Layardi* (Kelaart). *Sc. tristriatus* (W.) is common all over the low country to the south-west of the island. *S. Brodiei* (B. & L.) displaces it at Putlam, and is equally abundant in the north. It nearly resembles *S. tristriatus*, but is paler, and the tail is furnished with a long pencil tuft of hair, though this is easily lost in dried specimens. The voice too is far more shrill. The cry of these little animals more resembles the notes of a bird than the voice of a mammal; it reminds me of that note of the chaffinch (dear old home bird!) which has got it the name of "*Pink*." When the little *S. Brodiei* is alarmed at a prowling cat or snake, he clings to his favourite palmirah tree, head down and legs sprawling out, chattering defiance from his secure elevation, in the following language (*crescendo prestissimo*): "Chink, chink, chink, chink, chir-r-r-r-r, chink, chink, chir, chir, chink." The enemy moves—squg darts round the tree like lightning, head down again and tail flapping furiously (*molto prestissimo*)—chick, chick, chick—and now the chorus is taken up by every one within hearing. Every bird understands the signal, and is on the *qui vive*, and the spoiler's chance of a victim is small. Their cry to their young is a soft whistling note, very liquid and modulated. I first discovered this species in 1847, in the same year I discovered *Sc. Layardi* (B.), in the Ambegamoa range of hills, only one specimen of which has hitherto been procured; I shot it in dense jungle, being attracted to it by the voice. Not having any written description with me, I give you Blyth's:—"Size of *S. tristriatus*, but the colour very much darker, nearly as in *S. trilineatus*, but inclining more to ashy than to fulvous, except on the head and flanks: lower parts ferruginous, paler on the breast: middle of the back nigrescent, with a strongly contrasting narrow, bright, light, fulvous streak in the middle, reaching from between the shoulders to near the tail, and an obscure stripe on either side, barely reaching to the croup. Tail ferruginous along its centre, the hairs broadly margined with black

and finally with whitish; besides which is another and narrow black band on each hair towards its base, chiefly seen as the tail is viewed from above: tip black, forming a pencil tuft 3 inches long." Blyth calls it a "handsome species," and it certainly is so, its coat being very glossy and silky.

In 1849, while at Tangalle on circuit, I procured what I consider a new species. I have named it after my friend Dr. Kelaart, to whom be all honour for the persevering way in which he follows up the natural history of his native country. Well would it be for Ceylon if more of his countrymen and his cloth would imitate him! *Sc. Kelaarti* (Layard) replaces *S. tristriatus* from Tangalle, where I first saw it, to Kirindy, one day's journey beyond Hambantotte, and may be to Trincomalee. It is like *Sc. Palmarum* of India, but has a redder head, the colours of the back and belly are more blended, and the fur is longer and coarser. It is likewise smaller. Blyth, however, thinks this hardly separable from *S. Brodiei.* We are indebted to Kelaart for *S. trilineatus* (W.)—I do not know where he procured it—also for *Sciuropterus Layardi* and *Pt. oral,* neither of which I have seen, though I heard long since that two species of flying squirrels inhabited Rambodde Pass, and I believe Templeton procured one of them. I have not seen any description by Kelaart, but Blyth thus describes *S. Layardi*: "Nearly affined to *Sc. caniceps,* Gray, of the S.E. Himalaya, from which it differs in having the fur of its under parts of a dull non-fulvescent white, the parachute membrane being margined with pure white fur, lengthened and conspicuous at the angle. Face gray, except the forehead, which is rufous-brown like the rest of the upper parts. A dusky spot on the nose. Whiskers long and black: and there is a tuft of long soft hairs below the ears and a smaller one before them. The ear-conch is $\frac{3}{4}$ in. long posteriorly, ovate and somewhat narrow. Fur very dense, the basal three-fourths of the piles dusky, sinuous and fine in texture; the tips coarser, and shining dull rufous-brown forming the surface colour. Tail flat and broad, above nigrescent, and below deeper blackish except at tip. Feet grayish, with a faint rufous tinge on the hind only. Length about 2 feet, of which the tail with hair measures half: hind-foot from heel to tip of claws $2\frac{1}{2}$ in.: fore-foot to membrane $1\frac{1}{2}$ in." Kelaart gives its habitat, "Mountains of Ceylon (Dimbrula)."

But to resume my journey:—At 2 P.M. we started for Korremoaty, a village on the sea-shore, and at the head of the Mulletivoe Lake. The country through which we first rode was low and flat, and under paddy culture; the crop had been gathered in, and we rode over the fields, having to jump the "*balks*" or raised dams, every two minutes—not particularly pleasant with a loaded rifle on one's back. My horse would walk along these balks when he could, and finding it more pleasant than a succession of little jumps, I let him do so, which Q. observing, said I should have "a spill;" however, being obstinate, I kept on. Gradually leaving the cultivation we entered the jungle, at the edge of which Q. turned, and pointing to a dry tank, said, 'Five years ago I shot seven elk and three bears, in one

night, at that very spot. This place," added he, "is noted for bears,—so in fact is all Carretchy. Two years ago, when the great drought prevailed, the women never dared go for water to the wells, as is their custom, for the bears flocked out of the forest to the water, and it was no uncommon thing for the villagers to kill two or three a day;—poor Bruin, in his extremity, getting into the wells, whose loose sandy soil, not affording him any foot-hold, effectually prevented his escape." Thus chatting we threaded our way through the jungle. We had with us two rifles, two double guns and two single, including the collecting gun, and were anxiously hoping for elephants to show themselves, but they would not; so we contented ourselves by shooting small game, such as deer (*C. axis*), hares (*L. nigricollis*), and partridges (*P. Pondicerianus*). We saw one elk (*C. Hippelaphus*), but could not get a shot at it. The elk keeps more to the thick forest than the spotted deer, or axis, and is far more wary and shy. I observed *Treron bicincta*, *T. chlorigaster*, *Turtur humilis*, *T. risorius*, and *T. Suratensis*,—all very abundant except *T. humilis*, which is the rarest of our Turturs. *Macropteryx coronatus* is common, and a large "hornbill" (*Buceros*), which I have not been able to procure whole: a few casques that I have seen appear to belong to *B. violaceus*.

Our eastern twilight set in, and night fell rapidly, as we wound our way along a small nullah which bounded the jungle towards the Mulletivoe side. Q. said, "This is a noted place for cheetas:" at this time a rencontre would have been anything but agreeable; he had however hardly spoken, when a sullen growl from across the nullah proclaimed the presence of a nice neighbour. In a moment the sharp click of the rifles showed "make ready;" the spare guns which had lagged behind in "open order," closed up "double quick." The dogs raised their bristles and made ready for the combat; however he did not attack us, nor did we think it prudent to assail him in the darkness, so we passed silently and rapidly on into the open plains. After riding for an hour or two more, the guide came to a stand-still, bewildered; the young moon was gone, and Q. could not recognize any land-mark through the darkness, but felt sure we must be near our destination. Dismounting, we held a council of war, when it was determined that Q. should take the guide and try to find a path through a belt of jungle on our left, behind which we supposed the village to lie. A single shot was to call us to the rescue; a double, announce success, as I remained on the ground to collect the stragglers. Throwing a cloth over the horses to protect them from the night wind, which was piercingly cold and laden with dew, I threw myself on the ground to steal a nap, when quickly "bang-bang" and a British "hurrah" showed success; so firing a "feu de joie" to bring up the coolies, I hurried after Q. and found him sitting across a paddy pounder, lighting his cheroot, and abusing the owner of the house into whose premises we had got: the churl refused to give us fire, water, or any assistance. Q.'s tinder-box supplied the first, and we tore up some of his fence for fire-wood. He vowed he had not a fowl in his possession, but we detected him secreting a hen and chickens in a basket; these he protested were dedicated to the temple. Q. took one in his hand, pretending to admire it—*of course* repudiating the

idea of eating Pulliar's dinner; when, however, he replaced the chicken on the table, it could not stand, and the next instant rolled on its side, dead! Q. vowed Pulliar had done it, as he did not like anything that Europeans touched! I, however, had seen Q.'s brawny hand close over its breast in a manner not to be mistaken, and shortly it was in a curry before us. Q. spread his hammock, and I occupied the top of the table, which, if I attempted to turn, rolled over and deposited me on the ground. Our roof consisted of two cocoa-nut leaves, and though wet to the skin with the dew, we slept comfortably till morning, when, paying the man double for all we had consumed, we started for Matelan. Our course lay along the side of the Mulletivoe Lake, on which were vast flocks of water birds. The flamingoes rose in clouds, the noise of their wings resembling distant thunder, they themselves being a mile off. Ibises, pelicans, spoonbills, gulls, terns, and small waders, lined the shore, while overhead screamed the fish-eagle (*Blagus leucogaster*), and the kites (*Milvus ater* and *H. Pondicerianus*). On the opposite side of the lake lay heavy jungle, which Q., who knew every inch of the country, said contained vast quantities of satin-wood and ebony, and abounded in large game. We arrived at Matelan about 10 A.M., got breakfast and a nap, and at ½-past 3 P.M. started again for Mulletivoe. Part of our journey lay through the most splendid collecting ground I have yet seen—small patches of jungle bounding little wet spots full of water-fowl. We had not time to stop and collect any, but I noticed vast numbers of the anhinga (*Plotus melanogaster*), the night heron (*Nycticorax griseus*), pelicans, cormorants, spoonbills, and a (to me) new ibis, white, with naked black head: Q. says I shall see them abundantly by and by. Across the lake the old line of jungle lay unbroken, while that on our side was prettily diversified, now running far into the plain, now receding again; sometimes broken into little clumps, behind which pea-fowl, and deer, and partridges, and hares would suddenly come into view, and then seem far away. We found elephants' traces everywhere. Long strings of teal winged their way far overhead from one feeding-ground to another; white egrets sat gazing at us as we rode under their roosting-trees; while an occasional jackal, started by our dogs, would afford us a race over the yielding turf.

Of insects I saw but little, save an occasional *Callidyras* or *Euplœa*; rarely, an *Hipparchia* (which by the way is a new and undescribed species) would start up from some grassy tuft, and drop again as quickly into concealment. Doubtless the elephants' dung, and that of the numerous buffaloes and black cattle that dotted the plain, would have repaid a search for *Coleoptera*, but I had no time to spare and a long stage before me. Once, when passing through a spit of jungle, I fired at a splendid new pigeon; instantly up rose an enormous flight of flying foxes (*Pteropus edulis*, Peron); after wheeling several times round their roosting-place they settled again, hanging by their long claws in thick masses from the dead branches. Associated with them were night herons, and the flight of each is hardly to be discriminated: incongruous as the companionship appears, I found it similar at the lake between Tangalle and Matura. At dusk

we made the village of Mulletivoe, prettily embowered in palms and other eastern trees, &c., near the eastern head of the lake, which in wet weather forces an outlet for itself through a bar of sand into the sea. About a quarter of a mile up, the lake is crossed by a natural stone causeway, and over this we passed, glad enough to find no water running on it: had this been the case, the crossing, even in daylight, would have been difficult enough, with all the holes and cracks in it; we however found a herd of buffaloes crossing, and, conjecturing that they knew the way, stuck close to them and got over in safety. From the short glimpse I had of this curious formation in our hurried crossing in the darkness, I should say that it was a soft sandstone. It is little enough I know of geology, it is true; so I will not be answerable for this statement: Q. says it is much carried away by the natives and sold for grindstones. I could *hear* that it was very friable as we crossed it, and it was full of dangerous holes and cracks.

A sharp ride of some twenty minutes brought us to the hospitable house of my friend F., the police magistrate and assistant government agent, a young unmarried man. We found him surrounded by his friends and companions, two noble greyhounds (Australian I believe), and a large tribe of snow-white cats. While the bipeds were shaking hands, the quadrupeds pregathered as best they could, with much inward growling and spitting, and elevating of bristles and frizzing of tails. However, we soon changed our wet clothes and appeared in bachelor trim, pijamers and shirts, at the dinner-table.

Yesterday I was on the sofa all day, from the effects of a tick-bite in the hollow of the knee. These horrid pests are unfortunately very common throughout the jungle; the species are numerous, and their name Legion. One species is, I believe, innocuous; it is about half an inch long, and like a ball of the most beautiful crimson velvet. After rain or heavy dew they may be found in thousands on the wet sand.

In the evening I crept down to the beach and sat on an old boat, enjoying the breeze and watching the crabs enlarge their borders: this they effect in rather an odd manner, literally bringing up armfuls of sand, and, with a spring in the air, throwing it away from their burrows, distributing it in radii all round from the common centre, to the distance of a cubit or more. Their love-making is conducted in a most grotesque manner: the male struts about on the extreme end of his claws, like a beau on high-heeled shoes of the time of George the Second. After dancing about for some time in view of his ladye love, he perhaps raises a claw and wipes his protuberant eyes or his antennæ; suddenly he makes a frantic rush at the fair object of his affections: a desperate struggle ensues, and he presently runs off, pursued by the female, indignant no doubt at being so ungallantly ravished.

Well, I am tired of scribbling, and must get ready for starting at 3 P.M. today. I will write again, perhaps *en route,* but that must depend on my leisure, and how much time preparing specimens and my journal allow me.—Till then believe me very truly yours,

To George Johnston, Esq. E. L. LAYARD.

BIBLIOGRAPHICAL NOTICES.

Prodromus Floræ Batavæ. Vol. I. *Plantæ Vasculares. In sociorum imprimis usum edendum curavit Societas promovendo Floræ Bataviæ studio. Sumptibus Societatis,* 1850.

THIS work, which has only recently reached us, may be described as an extension of Koch's 'Synopsis Fl. Germanicæ' to the coast of Holland, and is very acceptable from the slightness of our previous knowledge of the native plants of the Dutch provinces. The present does not pretend to be more than a first attempt at a flora of those countries, but it is one which, notwithstanding its modest pretensions, will be of much value to the botanical geographer, and may be consulted with advantage by those who desire the completion of the catalogue of the British flora, since it will show what species may be expected to occur in our eastern counties as being frequent inhabitants of the neighbouring part of the continent. The number of these is not very considerable, and the following are perhaps those which are the most likely to reward a careful examination of the coasts of Norfolk and Suffolk, and the interesting sandy district of the interior of those counties.

Ranunculus ololeucos.
—— Baudoti.
—— polyanthemos.
Eranthis hyemalis (as a true native).
Nigella arvensis.
Braya supina.
Erucastrum Pollichii.
Elatine triandra.
Myosotis stricta.
Verbascum phlomoides.
Veronica latifolia.
—— longifolia.
—— præcox.
—— opaca.

Others might be mentioned, especially from amongst the *Gramineæ* and *Cyperaceæ,* but these will suffice.

We observe, that our author (for it appears to be almost certain that Dr. R. B. van den Bosch is the chief, if not sole author of this book) distinguishes a few plants as species which British botanists are accustomed to rank only as varieties. In some cases we believe that he is correct, but in others cannot concur with him. As examples we may instance the following:—

Ranunculus trichophyllus is separated from *R. heterophyllus* (the typical *R. aquatilis*), as we believe quite correctly, although we have not as yet found a good paper-character by which to distinguish them. Indeed, it seems probable that there is even a third species, the *Batrachium peltatum* of Fries, not Schrank, confounded under the name of *R. aquatilis.* The *Arabis hirsuta* is split into three species, *A. Gerardi* and *A. sagittata* being separated from it. In this we cannot concur, as we have not been able to see either habit or character by which to distinguish them.

The same remark may be made concerning *Montia minor* and *M. rivularis.*

Chrysanthemum maritimum is considered by our author to be quite distinct from *C. inodorum,* and characterized by its leaves having short

succulent and blunt segments; the flowers smaller than those of its ally; the involucre truncate at the base; and the receptacle broadly ovate. Several years since we were shown a plant which seems to possess these characters near Selsea by Mr. Borrer, and informed by him that it is the true plant of Smith. Whatever may become of the maritime plant of other parts of the British coast, we incline to the opinion that this Selsea form is really a distinct species from *C. inodorum.*

Carduus acanthoides and *C. crispus* are recorded as inhabiting his district, and, as seems to be the most correct view of the subject, they are retained as distinct species. This is also the opinion of Fries and of Godron. In Babington's 'Manual' the two names are given to forms of one species which appears to correspond with the *C. acanthoides* of those distinguished botanists, and as far as we are informed, the true *C. crispus* has not been found in Britain.

Polygonum lapathifolum and *P. Persicaria* are divided into *P. pallidum* (With.), *P. nodosum*, Pers., *P. laxum*, Reich., and *P. Persicaria*, Linn., the latter including two subspecies, the *P. agreste*, Fries, and *P. biforme*, Wahl. Their characters are taken avowedly from Fries's 'Mantissa,' ii. 23–28. We have not been able to satisfy ourselves concerning these plants, all of which are probably natives of Britain, although it has long been our desire to do so.

The *Rubi* are carefully described, in accordance rather with the views of Godron (Fl. France), than those of Swedish and British authors. The small number of the *Glandulosi* is remarkable, and will probably be much increased by their further study, as is suggested by the author.

In the equally difficult genus *Hieracium*, the views of Fries, as developed in his great work upon this subject (Symbolæ ad Historiam Hieraciorum), are followed.

Usually there are no generic or specific characters given, but in the few cases in which the definitions by Koch seemed to require emendation, or where additional species had to be described, they are added. The total number of species recorded is 1341: in the 3rd edition of the 'London Catalogue of British Plants,' we find 1487 (without reckoning the "excluded species"): in the 'Edinburgh Catalogue,' ed. 3, there are 1715. We have not time to count the species described in Babington's 'Manual,' ed. 3, but believe that it falls short of the latter number, although much more considerable than the former, which is reduced by the exclusion of very many species of the "critical" genera, such as *Rubus* and *Hieracium*, and the reduction to the rank of varieties of numerous other plants, considered as species by Babington and the Edinburgh botanists. If we bear in mind that the 'British Flora' includes a considerable number of western and arctic species, and that the Batavian list is confessedly imperfect in several of the less known genera, it will be seen that the flora is fully as great as was to be expected, when the nature of the country is remembered.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

November 26, 1850.—R. H. Solly, Esq., F.R.S., in the Chair.

List of Birds procured in Kordofan by Mr. J. Petherick. With notes by H. E. Strickland, M.A., F.G.S.

[Species not enumerated in Rüppell's 'Systematische Uebersicht der Vögel Nord-Ost-Afrika's,' 8vo, Frankfurt a. M. 1845, are marked N.

Species common to the West Coast of Africa are marked W. These are chiefly determined by reference to Dr. Hartlaub's valuable list of West African birds in the 'Verzeichniss der öffentlichen u. Privat-Vorlesungen am Hamburgischen Gymnasium,' 4to, Hamburg, 1850.]

1. *Neophron percnopterus.*
2. *Vultur occipitalis.*
3. *Otogyps auricularis.*
4. Buteo rufipennis, Strickland, n. s. Upper parts cinereo-fuscous, nearly black on the crown; feathers of back and wing-covers with black shafts; cheeks cinereous, a black line below them from angle of mouth; chin whitish, with a medial dark streak; breast and sides ferruginous brown, with a conspicuous medial black streak one-sixteenth of an inch wide on each feather; belly, thighs and vent plain fulvous; primaries and secondaries bright ferruginous, tipped for about an inch and a half with black, and from three to five distant transverse black bands on the inner web; tail cinereo-fuscous, with five dark fuscous bands, each about a quarter of an inch wide, the distal one about half an inch, beyond which the extremity is cinereo-fuscous and the extreme tip white; cere and legs yellowish; beak and claws black.

Length 17 inches; wing, $12\frac{1}{4}$; medial rectrices, $7\frac{1}{2}$; external ditto, $7\frac{1}{8}$; tarsus, $2\frac{1}{4}$.

Hab. Kordofan.

5. *Aquila nævia.*
6. *Aquila pennata.*
7. W. *Circaëtus brachydactylus.*
8. *Helotarsus ecaudatus.*
9. *Falco biarmicus,* Temm. (*F. peregrinoides,* Temm.; *F. chiqueroides,* Smith; *F. feldeggi,* Schlegel; *F. lanarius,* Schlegel; *F. rubeus,* Thienemann; *F. cervicalis,* Kaup.)

After a careful examination of many specimens, I feel justified in uniting the above synonyms under one species. This is essentially an African bird, extending from the Cape of Good Hope to Egypt, whence it has probably spread into Greece and Dalmatia, to which portions of Europe it is chiefly confined, though a single straggler has occurred in Germany. It is at once distinguished from *F. peregrinus* by the shorter toes, and the fulvous patch on the crown. The *Falco jugger,* Gray (*F. luggur,* Jerdon), of India is closely allied, but seems to differ constantly in the plumes of the tibia being uniformly dark brown, while in *F. biarmicus* they are cream-coloured or white,

like the rest of the under parts, with a small brown spot on the centre of each feather. This is one of the many species to which the name *Falco lanarius* has been given, under the supposition that it may be the *Lanner* of the old works on falconry; but as the original *F. lanarius* of Linnæus is now admitted to be the young of *F. gyrfalco*, and as systematists are generally agreed not to trace binomial titles further back than Linnæus's Systema, of course the specific name *lanarius* must be dropped altogether, and the oldest binomial name, *Falco biarmicus*, Temm., adopted for the present species.

10. W. *Tinnunculus alaudarius* (Gm.). This widely diffused species extends, without variation of form or colour, from Britain southwards to Central Africa and eastwards to India.

11. N. W. *Nauclerus riocouri*, Vieill.

12. *Accipiter sphenurus*, juv.? Resembles *A. sphenurus*, Rüpp., in the cuneate form of the tail. Head and neck rufescent, with a fuscous medial stripe on each feather; belly white, barred with brown; back cinereous brown with rufous margins; *upper tail-covers white*; tail cinereous, with three broad fuscous bars, outer feather white, with five bars.

13. N. *Accipiter carbonarius* (Licht.). Two specimens agree with Lichtenstein's description (in his Verzeichniss einer Sammlung von Saügethieren u. Vögeln aus dem Kafferlande, 8vo, Berlin, 1842, p. 11), except in having only *three* or *four* white bands on the tail instead of *five*. With the exception of these bands, and the numerous light and dark brown bands on the remiges, the plumage is wholly black; cere and legs yellow.

Total length, 12 inches; wing, 7; tarsus, $1\frac{6}{10}$.

14. W. *Melierax gabar* (Daud.). (*Accipiter erythrorhynchus*, Sw.)

15. *Melierax polyzonus*, Rüpp. United by Mr. Gray to *M. canorus*, Rislach (*M. musicus*, Daud.), but differs in its smaller size, and in having the upper tail-covers banded grey and white, while in *M. canorus* they are pure white. The wing in *M. polyzonus* measures 12 inches, in *M. canorus*, 15 inches.

16. W. *Polyboroides radiatus* (Scop.). (*Falco gymnogenys*, Temm.)

17. N. *Circus pallidus*, Sykes.

18. W. *Scops leucotis* (Temm.).

19. W. *Scotornis climacurus* (Vieill.).

20. *Caprimulgus infuscatus*, Cretzschm., female. Agrees with Rüppell's plate, but wants the white wing- and tail-spots of the male bird.

21. W. *Eurystomus afer* (Lath.). (*E. orientalis*, Rüpp.; *E. rubescens*, Vieill.; *Collaris purpurascens*, Wagl.)

22. W. *Coracias abyssinica*, Gm. (*Coracias caudata*, Wagl.)

23. W. *Coracias nævia*, Daud. (*C. levaillanti*, Rüpp.; *C. nuchalis*, Swains.)

24. W. *Ceryle rudis* (Linn.). (*Ispida bicincta*, Swains.; *I. bitorquata*, Swains.) Identical with specimens from Smyrna and S. Europe. The individuals with two pectoral bands (*I. bicincta*, Swains.) are the males.

25. N. W. *Merops albicollis,* Vieill. (*M. cuvieri,* Licht.; *M. savignyi,* Swains.)

26. W. *Merops nubicus,* Gm. (*M. superbus,* Shaw; *M. cæruleocephalus,* Lath.)

27. W. *Merops lamarcki,* Cuv. (*M. viridissimus,* Sw.; *M. ægyptius,* Kittlitz; *M. viridis,* Rüpp.) Closely allied to *M. viridis,* Linn., of India, but smaller, with a larger mixture of golden yellow in the plumage, the throat not blue as in *M. viridis,* and the remiges are rufous on *both webs,* with scarcely any tinge of green externally.

28. W. *Merops erythropterus,* Gm. (*M. minulus,* Cuv.; *M. collaris,* Vieill.; *M. lafresnayei,* Guérin.)

29. *Irrisor senegalensis* (Vieill.)? The Kordofan specimens agree, in the shortness and nearly straight form of their beak, with the black-beaked species of W. Africa, *I. senegalensis,* Vieill. (*Nectarinia melanorhynchus,* Licht.), but in the red colour of this organ they agree with the Cape species (*I. erythrorhynchus*). It is well known that the females of the latter have the beak much shorter and straighter than the males, yet in these Kordofan specimens the beak, though of the same length, is considerably straighter than in the female birds from the Cape. Like *I. senegalensis* they have a broad white bar crossing the inner webs of the first three, and both webs, shaft included, of the remaining primaries; while in *I. erythrorhynchus* the white bar of the primaries is much narrower, and divided by the black shaft.

30. *Nectarinia metallica,* Ehrenb.

31. W. *Nectarinia pulchella* (Linn.).

32. *Phylloscopus trochilus* (Linn.). Identical with British specimens.

33. *Saxicola deserti,* Temm.

34. *Saxicola œnanthe* (Linn.).

35. *Saxicola isabellina,* Cretzschm. This is probably the *Sylvia leucorrhoa,* Gm., in which case it extends to Senegal. It resembles *S. œnanthe,* but is paler on the upper part, and has less white on the lateral rectrices, the terminal black portion being $1\frac{1}{10}$ inch in length, while in *S. œnanthe* it is only about $\frac{3}{4}$ inch.

36. *Motacilla capensis,* Linn.

37. *Budytes melanocephala* (Licht.).

38. *Anthus* (undetermined species).

39. W. *Melænornis? erythropterus* (Gm.). (*Turdus erythropterus,* Gm.) This bird approaches nearly to the type of *Melænornis,* Gray (*Melasoma,* Sw.), though the beak is rather more elongated, and the rictal bristles less developed, than in *M. edoliolides,* Sw. Rüppell refers it to Boie's genus *Cercotrichas,* which is synonymous with *Copsychus,* Wagl. Dr. Hartlaub places it in *Argya,* Lesson, which is synonymous with *Chætops,* Sw.

40. W. *Pycnonotus barbatus* (Desfontaines). (*Turdus barbatus,* Desfont. in Mém. Ac. Sc. 1787; *Turdus arsinoe,* Licht.; *Ixos obscurus,* Temm.; *I. inornatus,* Fraser; *Hæmatornis lugubris,* Less.)

41. *Oriolus galbula,* Linn.

42. W. *Dicrurus divaricatus,* Licht. (*D. lugubris,* Ehrenb.;

D. canipennis, Swains.) Nearly allied to the *D. musicus*, Vieill., of S. Africa, but has the tail less deeply forked, the culmen of the beak more acute, and the primaries pale internally.

43. *Lanius algeriensis*, Less. in Rev. Zool. 1839. This is probably the species termed *L. excubitor* by Rüppell. It differs from the true *excubitor* of N. Europe in the greater extent of white on the primaries, and in the two external pairs of rectrices being wholly white (except the shafts). It closely approaches *L. lahtora* of India, and only differs in wanting the narrow band of black across the front.

44. *Lanius nubicus*, Licht. (*L. personatus*, Temm.)

45. *Lanius collurio*, Linn. A young male specimen appears referable to this species.

46. N. *Lanius isabellinus*, Ehrenberg, Symb. Phys. fol. *e*. This species is pale fulvo-cinereous above, cream-coloured below; rump and tail rufous; a broad blackish band from the nostril to the ear-covers, margined above by a whitish streak. It much resembles *L. arenarius*, Blyth, Journ. As. Soc. Beng. vol. xv. p. 304, but is of a more cinereous tinge above, and is distinguished from that and all the allied Asiatic species by possessing a conspicuous white band at the base of the fourth to the ninth primaries. The specimen from Kordofan has an obscure dark transverse band near the tips of the rectrices.

47. W. *Telophonus senegalus* (Linn.). (*Lanius erythropterus*, Shaw.)

48. W. *Corvus scapulatus*, Daud. (*C. leuconotus*, Sw.)

49. *Corvus umbrinus*, Sundevall. Distinguished by the length and curvature of the beak, and by the grey-brown tint of the head and neck.

50. W. *Juida rufiventris*, Rüpp.

51. W. *Juida chalybea*, Ehrenb. (*Lamprotornis cyanotis*, Sw.)

52. W. *Ploceus luteolus*, Licht. (*P. personatus*, Vieill., Jard. Contrib. to Ornith. 1849, p. 35. pl. 7.)

53. W. *Ploceus sanguinirostris* (Linn.).

54. W. *Pyromelana ignicolor* (Vieill.).

55. W. *Vidua paradisea* (Linn.). The series of immature specimens in the collection have enabled me to detect a curious structure connected with the development of the tail-feathers, which will be treated of in a separate paper. See Sir W. Jardine's 'Contributions to Ornithology,' 1850, p. 88. pl. 59.

56. W. *Vidua principalis* (Linn.). The specimen from Kordofan, like those from Senegal, has a black spot on the chin, but it is not yet proved whether the presence of this spot amounts to a specific distinction.

57. W. *Pytelia elegans* (Gm.).

58. W. *Amadina fasciata* (Gm.). (*Fringilla detruncata*, Licht.)

59. W. *Amadina cantans* (Gm.). A perfectly typical *Amadina*, though M. Rüppell makes it an *Estrilda*.

60. W. *Philetærus nitens* (Gm.). (*Amadina nitens*, Sw.) From the peculiar form of the beak I am disposed to refer this species, as well as *Estrilda squamifrons*, Smith, *E. musica*, Gray, and *Loxia frontalis*, Daud., to the genus *Philetærus*.

61. *Crithagra lutea* (Licht.), Temm. Pl. Col. 365.

62. W. ***Passer simplex***, Licht. (*Pyrgita swainsoni*, Rüpp.)

63. ***Emberiza striolata***, Rüpp.

64. *Galerida cristata* (Linn.)? This is probably the bird so designated by Rüppell, who states it to be abundant in the whole of N. Africa. It precisely agrees with European specimens in form, but is of a much paler colour, which however may be easily explained by the bleaching effect of the sun's rays in the scorching deserts which this bird frequents.

65. N. MIRAFRA CORDOFANICA, Strickland, n. s. Above ferruginous, the feathers of the crown and back with an indistinct medial dusky streak, and margined on their inner side with rusty white; tertials broadly margined with whitish, that colour being separated from the ferruginous of the medial portion by a narrow dusky line; secondaries ferruginous, margined externally with whitish; primaries ferruginous at the base, their distal half being pale rufo-fuscous; medial pair of rectrices ferruginous, the next pair pale rufo-fuscous, the two following pairs deep fuscous, with a very narrow rufescent margin, the penultimate pair deep fuscous internally; the external web, and part of the inner at the tip, white; external pair white, the inner web fuscous towards the base; cheeks pale rufo-fuscous, chin and throat white, breast and lower parts pale cream-colour, the former with a few pale rufo-fuscous subtriangular spots; lower wing-covers and sides rufescent; beak, feet and claws pale yellowish.

Total length, $5\frac{1}{4}$ inches; beak to front, $\frac{1}{2}$, to gape, $\frac{6}{10}$; wing, $3\frac{2}{10}$; medial and external rectrices, $2\frac{7}{10}$; tarsus, $\frac{9}{10}$; middle toe and claw, $\frac{7}{10}$; hind toe, $\frac{3}{10}$; hind claw, $\frac{2}{10}$.

This, which seems to be a typical *Mirafra*, is remarkable for the predominance of a pure ferruginous tint on its upper parts. The hind claw is remarkably short, though not more so than in some of the Indian species of *Mirafra*. The single specimen that occurred of this bird is now in the British Museum.

66. ALAUDA ERYTHROPYGIA, Strickland, n. s. Upper parts deep fuscous brown, the feathers narrowly margined with rufo-fulvous; upper tail-covers ferruginous; remiges deep fuscous, almost black on both webs, secondaries narrowly tipped with pale fulvous; tail fuscous black, the middle rectrices narrowly margined with ferruginous, the bases of all ferruginous, extending obliquely nearly to the tips of the outer pair. Lower parts pale fulvous, the chin, throat and breast with a broad medial fuscous streak on each feather; lower wing-covers black, margins of wing fulvous; beak fuscous; legs flesh-colour; hind claw short and slightly curved.

Length $7\frac{1}{2}$ inches; beak to front, $\frac{6}{10}$, to gape, $\frac{11}{10}$; wing, $4\frac{1}{4}$; medial and external rectrices, 3; tarsus, 1; hind claw, $\frac{3}{10}$.

Hab. Kordofan.

67. W. ***Colius macrurus***, Linn. (***C. senegalensis***, Gm.)

68. W. ***Tockus erythrorhynchus*** (Kuhl).

69. W. ***Palæornis torquatus***, Vig. (***P. cubicularis***, Wagl.) This species, which extends across Africa from Abyssinia to Senegal, is identical with specimens from India.

70. W. *Pogonius vieilloti*, Leach. (*P. senegalensis*, Licht.; *P. rubescens*, Temm.) N.B. This generic name was originally written *Pogonia* by Leach (Zool. Misc. vol. ii. p. 45), in which form it had been preoccupied by a genus of plants. Illiger's name, *Pogonias*, had also been preoccupied by a fish-genus; but Leach afterwards corrected it to *Pogonius*, which form had never been used before, and I therefore retain it instead of Mr. G. R. Gray's name *Læmodon* (erroneously written *Laimodon*).

71. *Trachyphonus margaritatus*, Rüpp. (*Tamatia erythropyga*, Ehrenb.)

72. *Yunx torquilla*, Linn. Identical with specimens from Britain and from India.

73. N. *Oxylophus serratus* (Sparrm.). This Cape bird has never before, I believe, been obtained to the north of the equator. The nearly allied *O. jacobinus* (Bodd.) of India (*Cuculus melanoleucus*, Gm.; *C. passerinus*, Vahl) has the lower parts constantly white. Ehrenberg, in his 'Symbolæ Physicæ,' fol. *r*, describes a Nubian species under the name of *Cuculus pica*, which from the description seems to be identical with the white-bellied *O. jacobinus* of India. Rüppell erroneously refers this *C. pica* of Ehrenberg to the *Oxylophus afer*, Leach (Levaill. Ois. Afr. pl. 209), of S. Africa, which differs in having dark streaks on the throat, and which appears from Rüppell's observations to be also an Abyssinian bird.

74. W. *Oxylophus glandarius* (Linn.).

75. W. *Columba guinea*, Linn. (*C. trigonigera*, Wagl.)

76. *Numida ptilorhyncha*, Licht.

77. *Francolinus clappertoni*, Vig. Mr. G. R. Gray has separated the *F. clappertoni* of Rüppell as a distinct species, under the name of *F. rüppelli*; but the specimens from Kordofan seem to agree equally well with Rüppell's plate of *F. rüppelli* and with Gray's plate of what he regards as the true *clappertoni*, between which I can see no difference.

78. *Coturnix dactylisonans*.

79. N. W. *Pterocles quadricinctus*, Temm. (*P. tricinctus*, Sw.) This African species has long been confounded with the closely allied *P. fasciatus* (Scop.), (*Perdix indica*, Lath.), of India, figured by Mr. Jerdon in his 'Illustrations of Indian Ornithology,' pl. 10 and 36. Specimens sent by Mr. Jerdon have now enabled me to prove their distinction. The general arrangement of colour is almost identical in these two species, the chief distinction being in the feathers of the back, scapulars, tertials and greater wing-covers, which in *P. fasciatus* are marked transversely with bars of a dull iron-grey (or "inky hue," as Mr. Jerdon well describes it), while in *P. tricinctus* these bands are of a deep glossy black. In *P. fasciatus* the wing-covers next the body have two or three of these dark bands alternating with white ones of equal breadth, the subterminal one being dark, and the tip of the feather ochreous yellow. In *P. quadricinctus* the wing-covers have only one black band, (or a very faint trace of a second,) narrowly margined on *both* sides with a fine white line, the terminal and basal parts of the feather being ochreous. Temminck's original

description of *P. quadricinctus* is evidently taken from the African bird, but he erroneously gives India as its habitat, in consequence of having confounded it with *P. fasciata*. Vieillot has increased the confusion by *figuring* the *quadricinctus* in his 'Galerie des Oiseaux,' pl. 220, under the specific name of *bicinctus*, while his *description* refers to the true *P. bicinctus*, Temm., a S. African bird.

80. W. *Otis rhaad*, Gm.

81. N. W. *Eupodotis denhami* (Vig.).

82. W. *Ortyxelos meiffreni*, Vieill.

83. W. *Œdicnemus crepitans*, Linn. This seems to me to be undistinguishable from *Œ. senegalensis* (Swains. Birds W. Afr. vol. ii. p. 228), the description of which agrees with the European bird.

84. *Œdicnemus affinis*, Rüpp. So exactly does this agree in size and form with *Œ. crepitans*, that I should have suspected it to be an immature bird, did not M. Rüppell appear so convinced of its distinctness.

85. *Pluvianus ægyptius* (Linn.).

86. *Glareola limbata*, Rüpp. Closely resembles *G. orientalis* of India, but has the external rectrices about an inch longer.

87. N. W. *Squatarola helvetica* (Linn.).

88. N. W. *Rhinoptilus chalcopterus* (Temm.). (*Cursorius chalcopterus*, Temm.) This, with the nearly allied *M. bitorquatus*, Blyth, of India, form a very distinct group, connecting *Cursorius* with *Charadrius*. Mr. Blyth first formed it into a genus, under the name of *Macrotarsus* (Journ. Asiat. Soc. Beng. vol. xvii. part 1. p. 254); but as the name has been previously used by Lacépède for genera of mammals and of birds, and by Schönherr for a coleopterous insect, I propose the name *Rhinoptilus*, indicating the advanced position of the frontal feathers, which, with other characters, distinguish it from *Charadrius*.

89. N. *Chætusia gregaria* (Pall.).

90. W. *Lobivanellus albicapillus* (Vieill.). (*Vanellus strigilatus*, Swains.)

91. W. *Hoplopterus persicus* (Bonn.). (*H. spinosus*, auct. recentiorum.)

92. W. *Sarciophorus pileatus* (Gm.).

93. *Charadrius hiaticula*, Linn.

94. *Charadrius alexandrinus*, Linn. (*C. cantianus*, Lath.)

95. *Charadrius pecuarius*, Licht.

96. W. *Ardeola coromanda* (Bodd.). (*Ardea coromandelensis*, Kuhl; *A. coromandelica*, Licht.; *A. affinis*, Horsf.; *A. russata*, Temm.; *A. bicolor*, Vieill.; *A. ruficapilla*, Vieill.; *A. bubulcus*, Audouin; *A. caboga*, Franklin; *A. verrani*, Roux; *A. lucida*, Raff.; *Lepterodas ibis*, Ehrenb.) I could have wished that M. Rüppell had given us the diagnoses of *A. bubulcus* and *coromandelica* when he pronounced them distinct. As far as my own comparisons extend, the African and Indian birds are specifically the same.

97. *Botaurus stellaris* (Linn.).

98. *Grus cinereus*.

99. W. *Ciconia alba*.

00. *Ibis æthiopica.*
101. W. *Glottis canescens* (Gm.). (*G. chloropus,* Nilss.)
102. W. *Totanus hypoleucus* (Linn.).
103. W. *Pelidna minuta,* Leisl.
104. W. *Pelidna subarquata* (Gm.).
105. *Machetes pugnax* (Linn.).
106. *Crex pratensis,* Bechst.
107. W. *Sarkidiornis africana,* Eyton.
108. *Chenalopex ægyptiacus.*
109. W. *Dendrocygna viduata* (Linn.). We have the authority of Jacquin, Azara, and other authors, for the occurrence of this bird in S. America. If this be the case, it will form the *only known instance* of a non-marine bird being indigenous to both the African and South American continents, without occurring in Europe, Asia, or North America. Before, however, admitting this remarkable exception to the laws of geographical distribution, the absolute specific identity of the African and American specimens should be established by careful comparison, which, as far as I am aware, has not yet been done.
110. *Sterna anglica,* Mont.
111. *Hydrochelidon nigra* (Linn.).
112. W. *Pelecanus rufescens.*

BOTANICAL SOCIETY OF EDINBURGH.

Feb. 12, 1852.—Professor Balfour, Vice-President, in the Chair.

Dr. Greville presented an additional collection of Fungi to the Society's Herbarium. Among them were some very good species from Jamaica, communicated and determined by Kunze; others from Schweinitz, of North Carolina, which are authentic for many of his published species.

The following papers were read:—

1. "On the Uses of *Stillingia sebifera,* the Tallow Tree of China, being the substance of a communication made to the Agricultural and Horticultural Society of India," by D. J. Macgowan, M.D. Communicated by Dr. Coldstream. The botanical characters of this Euphorbiaceous plant are too well known to require description, but hitherto no accurate account has been published of its varied uses, and although it has become a common tree in some parts of India and America, its value is appreciated only in China, where alone its products are properly elaborated. Dr. Macgowan remarks:—

"The *Stillingia sebifera* is prized for the fatty matter which it yields; its leaves are employed as a black dye; its wood, being hard and durable, is used for printing blocks and various other articles; and finally, the refuse of the nut is employed as fuel and manure.

"It is chiefly cultivated in the provinces of Kiangsi, Kongnain, and Chehkiang. In some districts near Hangchan, the inhabitants defray all their taxes with its produce. It grows alike on low alluvial plains and on granite hills, on the rich mould at the margin of canals, and on the sandy sea-beach. The sandy estuary of Hangchan yields little else. Some of the trees at this place are known to be several

hundred years old, and though prostrated, still send forth branches and bear fruit.

"In mid-winter when the seed-vessels are ripe, they are cut off with their twigs by a sharp knife, attached to the extremity of a long pole, which is held in the hand and pushed upwards against the twigs, removing at the same time such as are fruitless. The capsules are gently pounded in a mortar to loosen the seeds from their shells, from which they are separated by sifting. To facilitate the separation of the white sebaceous matter enveloping the seeds, they are steamed in tubs, having convex open wicker bottoms, placed over caldrons of boiling water. When thoroughly heated, they are reduced to a mash in the mortar, and thence transferred to bamboo sieves, kept at a uniform temperature over hot ashes. A single operation does not suffice to deprive them of all their tallow; the steaming and sifting is therefore repeated. The article thus procured becomes a solid mass on falling through the sieve, and to purify it, it is melted and formed into cakes for the press; these receive their form from bamboo hoops, a foot in diameter and three inches deep, which are laid on the ground over a little straw. On being filled with the hot liquid, the ends of the straw beneath are drawn up and spread over the top, and when of sufficient consistence, are placed with their rings in the press. This apparatus, which is of the rudest description, is constructed of two large beams placed horizontally, so as to form a trough capable of containing about fifty of the rings with their sebaceous cakes; at one end it is closed, and at the other adapted for receiving wedges, which are successively driven into it by ponderous sledge-hammers wielded by athletic men. The tallow oozes in a melted state into a receptacle below, where it cools. It is again melted and poured into tubs, smeared with mud to prevent its adhering. It is now marketable, in masses of about eighty pounds each, hard, brittle, white, opake, tasteless, and without the odour of animal tallow: under high pressure it scarcely stains bibulous paper: melts at 140° Fahr. It may be regarded as nearly pure stearine; the slight difference is doubtless owing to the admixture of oil expressed from the seed in the process just described. The seeds yield about eight per cent. of tallow, which sells for about five cents per pound.

"The process for pressing the oil, which is carried on at the same time, remains to be noticed; it is contained in the kernel of the nut, the sebaceous matter, which lies between the shell and the husk, having been removed in the manner described. The kernel and the husk covering it are ground between two stones, which are heated to prevent clogging from the sebaceous matter still adhering. The mass is then placed in a winnowing machine, precisely like those in use in Western countries. The chaff being separated, exposes the white oleaginous kernels, which, after being steamed, are placed in a mill to be mashed. This machine is formed of a circular stone groove, twelve feet in diameter, three inches deep, and about as many wide, into which a thick solid stone wheel, eight feet in diameter, tapering at the edge, is made to revolve perpendicularly by an ox harnessed to the outer end of its axle, the inner turning on a pivot

in the centre of the machine. Under this ponderous weight, the seeds are reduced to a mealy state, steamed in the tubs, formed into cakes, and pressed by wedges in the manner above described; the process of mashing, steaming, and pressing being repeated with the kernels likewise. The kernels yield above thirty per cent. of oil. It is called Ising-yu, sells for about three cents per pound, and answers well for lamps, though inferior for this purpose to some other vegetable oils in use. It is also employed for various purposes in the arts, and has a place in the Chinese Pharmacopœia, because of its quality of changing gray hair black, and other imaginary virtues.

"Artificial illumination in China is generally procured by vegetable oils, but candles are also employed by those who can afford it. In religious ceremonies no other material is used. As no one ventures out after dark without a lantern, and as the gods cannot be acceptably worshiped without candles, the quantity consumed is very great. With an unimportant exception, the candles are always made of what I beg to designate as vegetable stearine. When the candles, which are made by dipping, are of the required diameter, they receive a final dip into a mixture of the same material and insect-wax, by which their consistency is preserved in the hottest weather. They are generally coloured red, which is done by throwing a minute quantity of alkanet root (*Anchusa tinctoria*), brought from Shantung, into the mixture. Verdigris is sometimes employed to dye them green."

2. "On *Victoria regia*, Lindl.," by Edward Otto, Curator of the Hamburg Botanic Garden. Communicated by Mr. G. Lawson. This paper consisted of an account of the mode of treatment adopted in the successful cultivation of the Victoria in the Hamburg Botanic Garden, accompanied by observations on the plant's growth. The quickest development he observed in the case of the fifteenth leaf, from the 19th to 20th August, which increased about 9 inches in twenty-four hours, and from the 20th to 21st of the same month, when it increased 11 inches in twenty-four hours. The leaf-stalks only extend after the leaves are nearly full-grown.

3. "On the Structure and Reproduction of *Volvox Globator*," by John Sibbald, Esq. After giving a general description of this organism, the author proceeded to give a history of the opinions and observations which have been published concerning it. He alluded especially to the accounts given by Leuwenhoeck, Baker, and Ehrenberg, and next noticed the discussions concerning its nature which have been carried on by Siebold and Eckhard. But what was more particularly the subject of the paper, was the memoir lately published by Professor Williamson of Manchester. According to the observations of this gentleman, the *Volvox* is a confervaceous plant, and the animalcules described by Ehrenberg are merely the endochromes of the several cells, reduced to a small bulk by the secretion (between the outer cell-wall and the internal cell-membrane) of a hyaline substance. The cilia described by Ehrenberg as belonging to the individual animalcules are, according to Mr. Williamson, really attached to the external covering of the organism. Mr. Williamson also proposes the theory that the production of the young *Volvoces* consists more of a process of growth than reproduction, and refers

the true reproductive functions to certain bright granules, which are contained imbedded in the endochrome of each cell, these being the spores of the plant.

The author stated, that though in the main the observations of Mr. Williamson appeared to him to be correct, and that many of his deductions seemed legitimate, still there were some points in the memoir with which he could not agree. With regard to the parts from which the cilia are developed, he thinks that the various facts concerning them with which we are acquainted rather lead us to the belief that they are really developed from and properly belong to the cell-membranes immediately enclosing the endochromes of the cells. Next, as regards the organs of reproduction or spores, he could not agree with Mr. Williamson in thinking that the bright granules were the spores; he thought it seemed much more likely, and that it was borne out by analogy, to suppose that the whole masses of endochrome were the spores; and this, he said, seemed more probable if we regard the cilia as being attached thereto.

The author next entered into the question as to the animal or vegetable character of the *Volvox*; and after examining the arguments which might be brought forward to support either theory, he came to the conclusion that the organism should, without hesitation, be referred to the vegetable kingdom.

4. "On the Development of the Sporidia and Spores of *Lecanora tartarea*," by Wyville T. C. Thomson, Esq. The author gave a sketch of the structure of Lichens in general and of their mode of nutrition and reproduction. He considered spores as being the ultimate germinating cellules, the product of the division of the compound granular cell which is the result of the union of the conjugating cells in cryptogamic plants; sporidia as the compound granular cells, the product of the union of conjugating cells; proto-sporidia as the simple cells of lichens in which the two conjugating cells are afterwards formed; gonidia as free cellules derived from and part of the cellular tissue of the parent plant, capable of continuing to a certain extent their development when free from the parent, without the intervention of the true generative act of conjugation (the analogues of free buds or bulbils in Phanerogams). Mr. Thomson also considered the pro-embryo in Ferns and other Cryptogams as the cellular expansion formed by the development of the gonidium, and containing the conjugating cells. This pro-embryo, then, corresponds to the ordinary cellular expansion of Lichens.

The author then examined the structure of *Lecanora tartarea*, a crustaceous lichen holding a middle place between the foliaceous and the pulverulent species:—

"When we examine a section of the frond of *Lecanora tartarea*, we meet, in the layer which immediately adheres to the rock or bark, chosen for its place of growth, with a mass of elongated, more or less filiform cells. Most of these cells are empty—some of them contain a slightly viscid fluid, and in a few there appears to be an undeveloped nucleus; the cells are delicate and of a light gray colour. Resting immediately above these, and sometimes struggling down among them, are groups of rounded cells filled with bright-coloured chlorophyll,

not usually arranged in a continuous layer, but scattered in small irregular patches, or as isolated cells among the gray tissue. Above the green cells we meet with another layer of transparent tissue, closely resembling that below it. In *Lecanora*, we have above all a layer of somewhat flatter cells, forming an imperfect epidermal covering.

"The green tissue appears to represent the living and actively vegetating part of the lichen—determining by its development the form of the frond, and giving origin to all the other tissues. The cells appear to be in some degree independent of one another, though showing an evident tendency to form small aggregations. The gray tissue packs them in, and surrounds them, but appears to undergo no further change in development. It has powerful hygrometric properties, absorbing water rapidly and thereby undergoing great change of form.

"This tissue is replaced in many lichens by an unorganized colloid matter, also hygrometric to a great degree. It is sometimes nearly absent, and under whatever form it appears, it seems to act mechanically only, transmitting pabulum to the green layer, and keeping it surrounded by a sufficient quantity of moisture. The green cells termed gonidia frequently accumulate in masses, burst through the cuticular layer, and appear as a green powder on the surface of the plant. In this state the single gonidia are capable of continuing the powers of cell-development at a distance from the parent—forming round themselves the gray hygrometric tissue; and, like the parent plant, producing at length true reproductive organs. This is by no means a solitary instance of the formation of these, from developing cells in the vegetable kingdom. We have in the Ferns an instance of another order propagating through gonidia. In the Ferns, cells, long called spores, are found within modified leaves or parts of leaves. These cells, when placed in favourable circumstances of heat and moisture, develope, by nuclear division, a small cellular expansion (still part of the parent plant, as no process of cell-conjugation has intervened) called the pro-embryo. On this pro-embryo two cellules of different character appear, a union takes place between the different cells, and the product is an ovoid body, the sporidium. Within this sporidium, by nuclear division, spores are produced, only one of which comes to perfection, the others proving abortive. The spore is developed *in situ*, feeding upon the pro-embryo, as upon a cotyledon, and forming the new fern.

"To return to the Lichens. If we examine sections made through the frond of *Lecanora*—through the apothecia at various stages of growth, we meet at an early stage with a hollow sphere of delicate rounded cells (perithecium), surrounding a number of elongated filiform cells (paraphyses) arranged vertically in a rounded mass.

"Advancing a little farther in development, the cells of the perithecium above the centre of the mass of paraphyses have given way, and among the paraphyses a few flask-shaped, delicate cells (asci) are visible, closely resembling paraphyses distended and filled with mucus or cytoblastema.

"Very shortly the fluid contents become slightly granulated, and

the granules eventually aggregate into eight cytoblasts. Round these cytoblasts delicate rounded cells are formed which take at length an ovoid form, and we may generally easily perceive within them two free nuclei. Round these nuclei two secondary cells are developed, which gradually increase in size, so as nearly to fill up the parent cell. They become filled with densely granular chlorophyll, and finally the two cells conjugate; that is to say, the walls of both cells give way, and the granular contents amalgamate, nearly filling up the parent cell. The result of this conjugation is a large compound granular cell. Watching its further progress, we observe the granules becoming more and more distinct and defined, till at length the mother-cell bursts, and the contained cellules escape—at the same time the ascus gives way, and the cellules are dispersed as spores, to originate new individuals."

Dr. Balfour stated that Mr. Allan B. Dick (assistant to Dr. George Wilson) had analysed the leaf of *Livistona chinensis, Sabal umbraculifera, Chamærops humilis* and *arborescens*, grown in the Palm House of the Royal Botanic Garden, and had detected a very notable quantity of manganese in their composition.

Mr. M'Nab made a report on the state of vegetation in the Edinburgh Botanic Garden, from 8th January till 11th February. The communication embraced a register of the periods of flowering of plants in the open air, as compared with the flowering of the same species, and as nearly as possible the same individual plants, during the two previous years.

Mr. M'Nab also laid before the meeting a report of temperatures observed at the Botanic Garden from 8th January to 11th February 1852.

Mr. M'Nab read the following extract from a letter from Dr. G. M'Nab, Kingston, Jamaica, dated 13th January, 1852:—"With reference to your inquiries regarding the paper made from the Spanish Dagger Plant, I have to state that the Spanish Dagger is the *Yucca aloefolia*, a plant very common in this country for making fences; the fine paper-looking substance is obtained by breaking the lower part of the leaf along the midrib, and then pulling each half gently from the cuticle which covers the upper surface. It is most easily got from the young leaves, as in them only it separates freely; it can also be got equally well from the young leaves of the *Yucca gloriosa*. It is an excellent article for making artificial flowers, as it takes colours freely."

Mr. M'Nab exhibited specimens of the paper which he had prepared from the upper surface of the *young* leaves of *Yucca gloriosa* growing in the Botanic Garden, and he showed the method by which it was prepared.

Mr. William Keddie stated that he had found a vast profusion of *Batrachospermum vagum*, in the pools and rivulets immediately under the upper part of Goatfell, in Arran—about the place where the granite comes into contact with the schistose rocks. The plant is not commonly found in Scotland.

MISCELLANEOUS.

On a new genus of Chitonidæ. By HENRY and ARTHUR ADAMS.

To the Editors of the Annals of Natural History.

19 Hanover Villas, Kensington Park, March 13, 1852.

GENTLEMEN,—In pursuing our investigations into the *Chitonidæ*, we have met with a form which appears to us as much entitled to rank as a genus as any that have been so considered. We shall therefore feel obliged by your inserting the accompanying notice of it in your valuable Magazine.

We remain, Gentlemen, your very obedient servants,
HENRY and ARTHUR ADAMS.

Genus LORICA, H. & A. Adams.

Mantle covered with small, smooth, imbricated scales, the posterior margin deeply notched. Valves broad, the posterior small, with apex terminal, produced, the hinder margin notched; lateral areas of valves elevated, distinct.

Sp. *L. Cimolia.*
Chiton Cimolius, Reeve.

On the Appearance of large Swarms of Butterflies. By M. GHILIANI.

In the 'Gazetta Piemontese' of the 1st of May 1851, M. Ghiliani has given an account of the appearance of an extraordinary number of butterflies of the species *Vanessa Cardui*, Linn., in the neighbourhood of Turin. On the 26th of April, about eleven o'clock in the morning, millions of this species suddenly made their appearance; their number continued increasing till about one o'clock, when the atmosphere was darkened by them; at four o'clock they had disappeared, and only a few scattered butterflies were to be seen. M. Ghiliani only observed this phænomenon within a circle of about a mile round the town, but he thinks it must have occurred throughout nearly the whole of Piedmont. He attributes this circumstance to the non-exclusion of the autumn brood of the preceding year, caused, no doubt, by some extraordinary diminution of temperature. The greater part of these butterflies must have passed the winter in the pupa state, so as to undergo their metamorphoses in the spring, whilst those which made their appearance in the autumn would have hibernated under leaves or in the clefts of walls. It may also be supposed that, the southern face of the Ligurian Apennines having had a mild winter and an early spring, the *Vanessæ* of that district had been developed earlier than usual, so as to add to the number of those properly belonging to the environs of Turin. By means of these two suppositions M. Ghiliani explains—1st, the extraordinary number of these butterflies, and 2nd, the freshness of some, which had evidently only just escaped from the chrysalis, and the bad condition of others, which had undergone a long exposure to the inclemency of the weather.—*Revue et Magasin de Zoologie*, Nov. 1851, p. 559.

RARE IRISH MOLLUSCA.

To the Editors of the Annals of Natural History.

Windsor Lodge, Monkstown, co. Dublin, March 16, 1852.

GENTLEMEN,—I shall feel much obliged by your publishing the occurrence of the following Mollusca off the Waterford and Wexford coasts in the summer of 1851 :—

Gastrochæna modiolina; in limestone boulders, Tramore Bay, co. Waterford.

Venerupis Irus; same locality.

Thracia distorta; same locality.

Kellia suborbicularis; same locality.

—— *rubra*; among *Mytilus edulis* on the exposed sides of large rocks, Dunmore, co. Waterford.

Turtonia minuta; among *Lichina confinis* at or above high water, Dunmore, co. Waterford.

Nucula radiata; in fine sand dredged from about 45 or 50 fathoms, twelve miles off the Hook Light, co. Wexford.

Trochus Montagui; off the Saltee Islands, co. Wexford.

Eulima polita; dredged in 14 fathoms, gravelly bottom, off Portally, Dunmore.

Scalaria Treveliana; dredged in fine sand in 45 or 50 fathoms, twelve miles off the Hook Light, co. Wexford.

Odostoma Eulimoides? from the same locality as the last.

Chemnitzia rufescens? same locality.

Natica sordida; trawled in muddy sand 40 fathoms, off the Saltee Islands, co. Wexford.

Trophon muricatus; same locality.

Ovula patula; one specimen of a beautiful orange colour in a live state was found attached between the divisions of a specimen of *Alcyonium digitatum*, off the Saltee Islands, co. Wexford.

Bulla scabra; same locality as *Natica sordida*.

Gentlemen, yours truly,

WILLIAM WHITE WALPOLE.

On the Insects injurious to the Rape Crops. By M. AD. FOCILLON.

The object of the author of this memoir is to furnish the results of his observations, as to the cause of the loss which had been sustained during several years by the cultivators of rape-seed, from the ravages of certain insects. The period at which he commenced his observations (the end of June) was too late in the season to allow time for their completion, and he has accordingly put off till another year the investigation of the natural history of the noxious insects, and the consideration of the best means of destroying them. The problems which he has endeavoured to solve during the present season are the following :—

1. What are the causes of the devastation, and by what means may they be distinguished from one another?

2. What importance should be attributed to them?

The damage done to the rape-plants, in the fields of the "Institut Agronomique" (where these observations were carried on), is due to five perfect insects and three larvæ.

The former consist of four species of *Haltica*, and a new species of weevil belonging to the genus *Grypidius* of Schönherr. This curious insect passes its slender curved rostrum through the walls of the pod to the centre of the seed, where it gnaws a large hole. The seeds thus attacked, if not ripe or nearly so, become abortive; if ripe, they lose a considerable portion of their substance; and as, from their position, the rostrum of the weevil always cuts the radicle, they are rendered incapable of germinating. A very small hole in the valve of the pod is the only external trace of its attacks left by this insect.

The four species of *Haltica* attack and destroy the young plants as soon as they are above ground; they sometimes gnaw the parenchyma of the seed-vessels, but apparently without injuring the seeds.

The larvæ are the most destructive enemies of the crops. The first M. Focillon believes to be that of the weevil above-mentioned (*Grypidius brassicæ*). It is about 3 millimetres in length and $1\frac{1}{2}$ in breadth, white, footless, with a shining black scaly head. It inhabits the interior of the pod, where it devours three or four seeds; its presence is known by the blackish colour of the seed-vessels. When mature it gnaws a round hole in one of the valves of the pod, by which it passes out, and no doubt goes down into the earth to undergo its metamorphosis.

Very similar ravages are committed by the caterpillar of the *Ypsolophus xylostei* of Fabricius. This is about 9 millimetres in length, of a pale green colour, bristled with black hairs, and with the head black. Like the preceding larva it lives in the pods until the period of its transformations, when it passes out through a round hole which it forms in one of the valves. After leaving the pod it spins a cocoon of very loose meshes, in which it remains fifteen days in the pupa state. The moth appears, usually, in June.

The third larva is about 2 millimetres in length, and during the greater part of its life is of a white colour. Great numbers of them are found in some pods, which soon become moist, and finally wither and become mouldy, together with a larger or smaller quantity of the seeds which they contain. M. Focillon has not yet ascertained the perfect state of these larvæ, which are known to the agriculturists by the name of the "small white worm."

The importance of these ravages will be readily understood from the following statements:—Cleaned rape-seed contains 45 per cent. of oil, and deducting that which is retained by the rape cake, there is a return of about 34 per cent. This return will be larger if there are more sound seeds, and if all were in this state, it would rise to 36·6 per cent.

The seeds eaten by the larvæ of the weevil and moth give no oil.

The seeds damaged by the small white worm lose 28·5 per cent. on the quantity which they should have yielded. The seeds pierced by the weevil in the perfect state sustain a loss of oil equal to 18·2 per cent. From these data M. Focillon has arrived at a mode of calculation by which the loss of oil on a given crop of rape-seed may readily be ascertained. According to these calculations, M. Focillon states the loss on the crop of rape-seed raised by the above-mentioned Institution in 1851, at 2800 francs out of 7500.

The result of experiments made to ascertain the effect of the attacks of the insects on the germinative faculty of the seeds is as follows:—The seeds eaten by the larvæ of the weevil and moth and those pierced by the perfect weevil do not germinate. Of 100 seeds affected by the small white worm only 52 germinated, whilst out of 100 sound seeds the average number was 80.—*Comptes Rendus*, 1852, p. 252.

Note on a species of Coccus, *indigenous to France, which lives on the Common Bean, and appears to be capable of furnishing an abundant Colouring Matter which may be used in the Arts.* By M. Guérin Méneville.

This new *Coccus* (*Coccus Fabæ*) when crushed in linen or paper furnishes a red colour, sufficiently intense to raise hopes that it may perhaps contain as much colouring matter as the Mexican cochineal.

What renders this indigenous cochineal very interesting is, that it would be possible to cultivate it and raise regular crops of it. It lives on *Vicia Faba*, on which it is so abundant, that I have been able, in a few hours, to collect a considerable quantity of these cochineals, by brushing the plants covered with them over a cloth. I treated them in the same manner as that by which the *Coccus Cacti* is prepared—killing them in boiling water and afterwards drying them in the sun. By these means I have obtained an article which offers a considerable resemblance to the cochineal of commerce, and may, even now, be the subject of some experiments in dyeing, should the Academy think fit to ask M. Chevreul to undertake them in his laboratories.

As I brought with me a considerable number of living cochineals, I have been enabled to continue the study of their habits in Paris, and have seen that the myriads of eggs which they laid last autumn were hatched during the winter, and that young ones proceeding from them are able to live without nourishment until they meet with the plants on which they feed.

I have instituted an experiment on rather a large scale at Sainte Tulle, and I hope this year to raise a sufficient crop of this cochineal to enable experiments to be made on larger quantities, should the results of those which I have ventured to ask of M. Chevreul, give any encouragement to follow out this new application of entomology.

Some very curious parasites on this cochineal have been discovered this winter, and will probably give occasion for some interesting scientific observations.—*Ib.* March 1852, p. 334.

OBITUARY.—H. N. TURNER, JUN.

Our readers will be grieved to hear of the death of Mr. H. N. Turner, jun., a young and ardent worker in osteology, and one, who, while his amiability endeared him to all his acquaintance, was regarded, by those best qualified to form an opinion, as one of the most promising comparative anatomists of the day. Most of his papers were read before the Zoological Society, and appeared in the Proceedings of that Society and in this Journal; they were chiefly directed to demonstrating the importance which he considered should be attached to the position of the cranial foramina in the classification of the Mammalia.

In August last, he had the misfortune to prick his finger whilst dissecting, and after being confined to his room for more than five months, he was carried off by an attack of rheumatic fever, with which his debilitated constitution had no strength to contend. Thus, while his much-lamented death affords a lesson of caution in the use of dissecting instruments to every anatomist, his short life gives an ample illustration of what may be done for science by well-directed zeal and unremitting perseverance.

METEOROLOGICAL OBSERVATIONS FOR FEB. 1852.

Chiswick.—February 1. Rain: clear and fine. 2. Rain: cloudy and mild: densely overcast. 3. Clear: exceedingly fine: clear at night. 4. Uniformly overcast: rain. 5. Densely clouded: rain. 6. Clear: slight shower: clear: frosty. 7. Clear: very fine: overcast. 8. Boisterous, with rain: overcast: rain. 9. Cloudy and fine: showery: clear. 10. A few snow-flakes: cloudy and cold: clear at night. 11. Clear and frosty: fine: sharp frost at night. 12. Frosty and foggy: very fine: clear: slight frost. 13. Densely overcast: fine: overcast. 14. Hazy: uniformly overcast: clear. 15. Overcast. 16. Fine: densely overcast. 17. Cloudy: fine. 18. Low white clouds: clear. 19. Clear and cold. 20. Clear and frosty: very sharp frost at night. 21. Severe frost: fine. 22. Cloudy and cold. 23. Fine, but cold. 24, 25. Clear and cold. 26. Slight rain: uniformly overcast. 27. Cloudy: rain. 28. Slight rain: clear at night. 29. Clear: overcast and cold.

Mean temperature of the month	38°·72
Mean temperature of Feb. 1851	38 ·44
Mean temperature of Feb. for the last twenty-six years ...	40 ·06
Average amount of rain in Feb.	1·62 inch.

Boston.—Feb. 1. Fine. 2. Cloudy: rain early A.M. 3. Fine. 4, 5. Rain: rain A.M. and P.M. 6. Fine: stormy. 7. Fine. 8. Rain: rain early A.M. and P.M. 9. Cloudy: rain with lightning A.M. and P.M. 10. Cloudy: rain A.M. and P.M. 11, 12. Fine. 13, 14. Cloudy. 15, 16. Cloudy: rain P.M. 17. Cloudy. 18—21. Fine. 22, 23. Cloudy. 24. Fine. 25. Cloudy. 26. Cloudy: rain early A.M. and P.M. 27. Fine. 28. Cloudy. 29. Fine.

Sandwick Manse, Orkney.—Feb. 1. Clear: fine: aurora. 2. Cloudy. 3. Cloudy: sleet-showers. 4. Rain: showers. 5. Showery: clear. 6, 7. Sleet-showers. 8. Drizzle: rain. 9. Sleet-showers. 10. Bright: clear. 11. Cloudy. 12. Cloudy: clear: aurora. 13. Bright: showers: aurora. 14. Drops: drizzle. 15. Bright: hail-showers: S. aurora. 16. Hail-showers: S. aurora. 17. Rain: snow-showers: S. aurora. 18. Snow-showers: S. aurora. 19. Snow-drift: S. aurora. 20. Bright: cloudy. 21. Thaw: cloudy: aurora. 22. Cloudy: aurora. 23. Fine: cloudy: fine. 24, 25. Cloudy: fine. 26. Cloudy: showers. 27. Showers: drizzle. 28. Snow-showers: showers. 29. Snow-showers.

Meteorological Observations made by Mr. Thompson *at the Garden of the Horticultural Society at* Chiswick, *near London*; *by* Mr. Veall, *at* Boston; *and by the* Rev. C. Clouston, *at Sandwick Manse*, Orkney.

Days of Month.	Barometer.					Thermometer.					Wind.			Rain.		
	Chiswick.		Boston. 8¾ a.m.	Orkney, Sandwick.		Chiswick.		Boston. 8¾ a.m.	Orkney, Sandwick.		Chiswick. 1 p.m.	Boston.	Orkney, Sandwick.	Chiswick.	Boston.	Orkney, Sandwick.
1852. Feb.	Max.	Min.		9¼ a.m.	8½ p.m.	Max.	Min.		9¼ a.m.	8½ p.m.						
1.	29·996	29·717	29·22	29·46	29·65	57	39	51·5	41	40	w.	w.	sse.	·04	·24	·09
2.	30·003	29·850	29·53	29·22	29·29	53	35	47	46	43	sw.	sw.	sw.	·04	·02	·04
3.	30·142	30·016	29·55	29·26	29·26	51	34	38·5	42	43	sw.	sw.	w.	....	....	·09
4.	30·191	29·810	29·56	28·93	28·78	55	44	41	41	43½	sw.	sw.	wnw.	·13	....	·33
○ 5.	29·739	29·641	29·23	29·29	29·24	55	43	48	39	38½	sw.	sw.	w.	·23	·09	·43
6.	30·098	29·648	29·15	29·51	29·69	49	27	44	38	41	nw.	nnw.	nw.	·01	·15	·09
7.	30·155	29·994	29·72	29·61	29·49	50	41	36	43	43	nw.	w.	w.	·02	....	·22
8.	30·178	29·463	29·10	29·00	29·75	53	36	49	43	41½	sw.	w.	nw.	·38	·10	·30
9.	29·461	29·111	28·73	29·12	29·49	45	25	43	35	42	sw.	nnw.	nw.	·05	·13	·54
10.	30·036	29·631	29·35	29·93	30·03	45	25	39	38	36	n.	n.	sw.	·02	·10	·06
11.	30·099	29·998	29·80	29·72	29·75	44	17	30	39½	43	n.	n.	sw.	....	·05	....
☾ 12.	29·914	29·664	29·65	29·53	29·46	43	25	30	42½	41½	s.	s.	s.	....	....	·03
13.	29·824	29·584	29·33	29·45	29·62	42	30	33	40	39	s.	s.	w.	....	....	....
14.	30·206	30·008	29·74	29·65	29·65	43	22	34	40	47	se.	w.	w.	....	....	·28
15.	30·191	30·100	29·72	29·56	29·47	49	33	41	45½	37	sw.	w.	w.	....	....	·04
16.	30·176	29·777	29·18	29·42	29·45	53	43	40	37	40	sw.	w.	w.	·04	·03	·25
17.	29·858	29·558	29·40	29·45	29·22	56	37	49	38	37	w.	nnw.	w.	·03	·05	·05
18.	29·737	29·596	29·15	29·44	29·72	46	27	39	30½	31	nw.	nw.	n.	....	....	·31
19.	30·018	29·783	29·50	29·94	30·08	39	23	31	29	27	nw.	nnw.	n.	....	....	·11
● 20.	30·186	30·117	29·82	30·14	30·05	38	15	27	35	33½	nw.	nnw.	sw.	....	....	·02
21.	30·362	30·233	29·96	29·98	30·22	42	32	24	42½	39	w.	wnw.	nw.	·01	....	·22
22.	30·574	30·423	30·17	30·33	30·46	46	22	34	43½	46	ne.	nne.	w.	....	....	·03
23.	30·637	30·572	30·37	30·60	30·63	46	23	34	45	47	ne.	e.	s.	....	....	·03
24.	30·500	30·362	30·24	30·54	30·48	42	31	34·5	45½	45	ne.	e.	sw.	....	....	....
25.	30·333	30·205	30·07	30·60	30·71	45	29	37·5	41½	37	e.	e.	ne.	....	....	....
26.	30·334	30·225	30·06	30·51	30·30	43	33	38	41½	42	ne.	ne.	nw.	·01	·02	....
27.	30·136	29·963	29·80	30·09	29·72	46	32	36·5	45	45½	n.	nnw.	nw.	·03	·02	·11
☽ 28.	29·715	29·628	29·33	29·62	29·72	50	30	42·5	35½	36½	nw.	nnw.	nw.	·01	....	·07
29.	29·872	29·739	29·47	29·74	29·69	43	24	37	34	34½	nw.	nw.	nw.	·01	....	·07
Mean	30·092	29·842	29·58	29·711	29·761	47·20	30·24	38·24	39·89	40·00				1·04	1·00	3·81

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SECOND SERIES.]

No. 53. MAY 1852.

XXIX.—*Sketch of a Classification of Recent Brachiopoda; based upon Internal Organization.* By Thomas Davidson, Member of the Geol. Soc. of France, &c.

The numerous dredgings undertaken under different latitudes and in deep as well as shallow seas, have shown that recent Brachiopoda are more numerically abundant and varied in generic and specific forms than we formerly supposed. The best account of the species of this order is contained in the monograph by Mr. G. B. Sowerby, published in his 'Thesaurus Conchyliorum,' 1846. In that work fifty-seven recent species are described and arranged under five genera, viz. *Lingula, Terebratula, Orbicula, Crania* and *Thecidea*.

Of late years many other genera have been proposed, and in a minute investigation of the interiors of all the species of *Terebratula*, I found so much variation in the dispositions of the calcareous appendages, as to necessitate a complete subdivision and re-arrangement of the shells usually associated under that name. All the known and described species, with two or three exceptions only, are to be found in the magnificent collection of Mr. Cuming, who in the most obliging manner placed his specimens at my disposal for examination. I am also greatly indebted to Mr. Gray of the British Museum, and Prof. Forbes, for the means of examining the animal of many genera and species; these investigations, undertaken along with Mr. Woodward of the British Museum, have proved of great assistance in enabling us to ascertain what relation the calcareous supports or appendages bear to the soft parts of the animal, and more especially to the arms, in the different genera.

It is not the object however of this paper to give descriptions and synonyms of the different species, which will be included in the catalogue of Brachiopoda Mr. Gray is about to publish for

the British Museum. My only object is to point out how all the sixty-six or sixty-seven known species may be classed according to their structure and affinities. In drawing up any scheme for the arrangement of the Brachiopoda, due regard must be paid to the extinct species, which vastly outnumber those of the present seas. The family *Rhynchonellidæ* for example afford only two living species, whereas several hundred are known in a fossil state: and in the same manner the proposed subdivisions of *Terebratulidæ* become more important in reference to the number of species which no more exist. When we open and examine the numerous species possessed of calcareous appendages, we observe that these vary in shape and arrangement, and that under each form or type a number of species can be clustered all very similar in their structure; these form *genera* or *subgenera*, more or less intimately or distantly connected, as will be shown hereafter, and thus enable any one to know by the generic appellation, what is the form and disposition of the skeleton or loop in all the different species. The subdivisions of the great genus *Terebratula*, are based chiefly on the extent and form of the apophysary system or loop, and my object has been to ascertain how far the form of the loop can be associated with the modifications in the soft parts of the animal and in the more obvious external characters presented by the shell. The woodcuts which accompany this paper will serve to render the generic descriptions more complete and readily understood.

It can scarcely be expected that this first attempt to classify the recent species of living *Terebratulidæ* should be entirely successful, but such a classification has become not only desirable but necessary, and no good would be accomplished by delaying its publication. With these few preliminary observations I will propose the following arrangement.

Class BRACHIOPODA, *Dumeril.*

Order Lamellibranchiata, Blainv.

Animal attached to submarine bodies by a muscular peduncle or by the substance of its ventral valve: furnished with a pair of ciliated arms, sometimes supported by a calcareous appendage: respiration performed by the vascular mantle, &c.

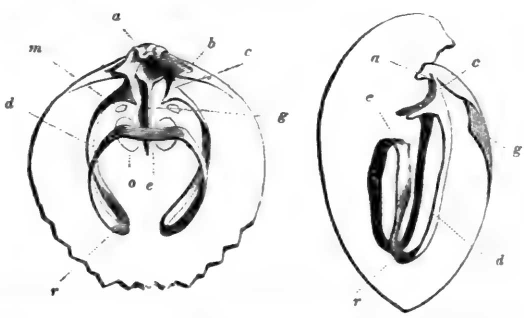
Typical Family. I. Terebratulidæ.

Shell minutely punctate, inequivalve, usually subcircular and smooth or striated: the ventral or dental valve generally the largest, its beak notched or perforated for the passage of the peduncle: dorsal, socket, or receiving valve, furnished internally with a cal-

careous process or loop for the support of the arms. These vary in their dispositions and details in the different genera, but could not be protruded from the shell as they are united together by a membrane, which effectually maintains them in one invariable position; they have no connection with the opening and closing of the shell, as supposed by some authors, which is accomplished by special muscles passing from the centre of the perforated valve to the fulcrum of the smaller valve; thus in those genera possessed of a calcareous loop the disposition of the ciliated arms is not regulated or restrained by the form of the loop, a point I was not convinced of before having entered into the zoological details of these animals.

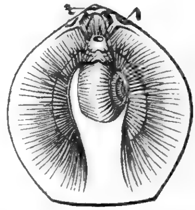
I. Genus Terebratula, Lhwyd, 1698 (restricted).

Shell usually oval, and convex, with the margins even or only slightly waved; valves articulating by means of two teeth in the larger and corresponding sockets in the smaller valve: beak of dental valve truncated and perforated by a circular foramen partly completed by a deltidium formed of one or two pieces. Loop or calcareous appendage variable in length, formed of two riband-shaped lamellæ fixed to the crural base, and more or less folded back on itself. The arms are partly supported by this appendage, but they do not strictly follow the same course; thus the form of the arms is the same in *Terebratula vitrea*, with a small loop, and in *Terebratula australis* which has a long one; the arms in both cases are united throughout by a membrane forming three lobes, of which the central one is spirally folded like the proboscis of a butterfly, but from its texture and relations it never could be moved or unrolled at the will of the animal; the sole use of the folding of the arms is to give increased surface for the disposition of the cilia.



The letters in the diagrams of *Terebratula* and *Terebratella* are intended to facilitate a comparison of the same parts.

Section A. *Terebratulæ with a short loop.*



1. *Terebratula vitrea,* Linn. sp., 1773; Sow. Th. Conch. pl. 70. fig. 56. 59*.

Hab. Mediterranean, dredged by Prof. Forbes in 92 to 250 fathoms in nullipore mud. Many specimens of cretaceous *Ter. carnea* are undistinguishable from this living species.

2. *Terebratula uva,* Brod. 1833; Zool. Proc.; Sow. Th. Conch. pl. 70. fig. 53–55.

Hab. From the Gulf of Tehuantepec. I have never seen but one specimen of this species; its loop is broken, but I think it was similar to that of *T. vitrea.*

Section B. *Terebratulæ with a long loop.*

3. *Terebratula Cranium,* Muller sp., 1776; Zool. Dan. Prod.; Sow. Th. Conch. pl. 70. fig. 60–62.

Hab. Coast of Norway and North Sea; dredged by Dr. Fleming in deep water eastward of Bressay in Zetland.

4. *Terebratula globosa,* Lam. 1819; Sow. Th. Conch. pl. 71. fig. 99–101.

Hab. Unknown. Some uncertainty exists if the species of Lamarck (Ency. Méth. pl. 239. fig. 2) is the one figured by Sowerby from Mr. Cuming's collection.

5. *Terebratula picta,* Chemn. sp., 1785; Sow. Th. Conch. pl. 70. fig. 43, 44.

Hab. Java.

6. *Terebratula dilatata,* Lam. 1819; Sow. Th. Conch. pl. 70. fig. 48, 49.

Hab. Straits of Magelhaens: I can perceive no difference between this shell and *Ter. Californiana,* except in the size of the foramen, which is small in Koch's species.

7. *Terebratula Californiana,* Koch; Küster, Nov. Ed. Martini Chem. vol. viii. 1843, pl. 2 *b.* fig. 21–23; Sow. Th. Conch. pl. 70. fig. 50, 52.

Hab. Coast of California.

* For convenience, and to avoid referring to numerous works, we will in this short paper mention only the figures in Sowerby's 'Thesaurus Conch.' 1849.

8. *Terebratula lenticularis,* Deshayes, 1830; Sow. Th. Conch. pl. 72. fig. 108–110.

Hab. Cook's Straits, New Zealand, depth 15 fathoms: this species is found fossil in the island.

9. *Terebratula Grayii,* Dav. Zool. Proc. 1852.

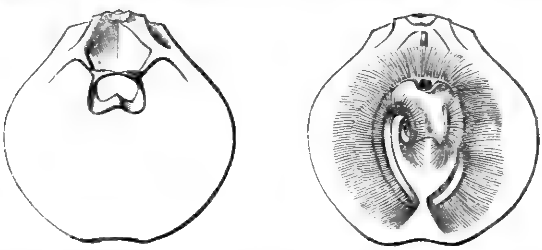
Hab. Straits of Korea.

10. *Terebratula australis,* Quoy, 1834; Sow. Th. Conch. pl. 69. fig. 25, 34.

Hab. In shallow seas, depth 4 feet; according to Quoy. *Ter. flavescens* and *dentata,* Lam. 1819, and *T. recurva,* Quoy, are only varieties and malformations.

II. Genus Terebratulina, D'Orb. 1849.

Closely allied to *Terebratula,* but differing in the union of the crural processes, which form a shelly band behind the mouth of the animal, whereas the reflected border of the loop is always in front (below in the figure) of the mouth: in young specimens of the recent *T. Caput-serpentis,* the crural processes are not joined,



showing an intimate relation to *Terebratula vitrea.* The disposition of the ciliated arms is the same as in *T. vitrea* and *australis*: the figure has been taken with the cilia a little out of their proper place to show some points more clearly, and especially for comparison with the type of *Argiope.* The arms are united by a membrane which forms a flat disc in *Argiope,* but here forms three lobes as described under *Terebratula.* Apart from the peculiarity of the loop, the *Terebratulinæ* form a small group, so well characterized by form and sculpture as never to be confounded with any other. The beak is truncated, and the foramen partly encircled by a deltidium united or disunited in different species; the two ear-like expansions on the sides of the umbo are also characteristic of this genus.

A great many recent species have been proposed by various authors, but after a minute comparison of these, they must I fear be reduced to five or six.

11. *Terebratulina Caput-serpentis,* Linn. sp., 1773; Sow. Th. Conch. pl. 68. fig. 1–4, &c.

Hab. Many parts of the Scottish coast, &c., in from 10 to 50 fathoms: this species is likewise found fossil in all the strata from the chalk upwards.

12. *Terebratulina septentrionalis,* Couthouy sp.; Sow. Th. Conch. pl. 68. fig. 5, 6, 1846.

Hab. Coast of Maine, Massachusets.

13. *Terebratulina Japonica,* Sow. sp., 1846; Th. Conch. pl. 68. fig. 7, 8.

Hab. Seas of Japan.

14. *Terebratulina cancellata,* Koch sp.; Küster, Neur. ed. Martini Chemnitz, vii. 1. t. 2 *b*. fig. 11–13.

Hab. Unknown.

15. *Terebratulina abyssicola,* Adam and Reeves, sp. 1850, Voy. of Samarang.

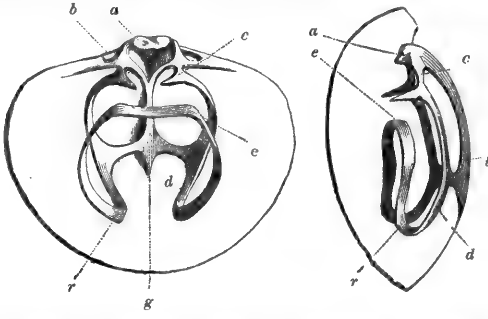
Hab. Cape of Good Hope, depth 120 fathoms; these two last-named species require further examination.

16. *Terebratulina Cumingii,* Dav. Zool. Proc. 1852.

Hab. China seas.

III. Genus Terebratella, D'Orb. 1847.

The animal of this genus has been well described by Prof. Owen in the 'Trans. of the Zool. Soc.;' it differs from *Terebratula* by its loop being doubly attached; the lamellæ proceeding from the crural base, before attaining their greatest length, give off a



flat, wide, more or less horizontal process, likewise affixed to a more or less elevated longitudinal septum, the lamella proceed-

ing again and doubling itself in the shape of a loop as in *Terebratula.* The variations in the details and in the position of the lamella and septum in some species of *Terebratella,* such as *T. crenulata, Evansii* and *Cumingii,* connect this genus with *Magas,* so that the last genus will *not* form a separate family as generally supposed.

Fourteen or fifteen species of recent *Terebratella* have been described and figured, all in general characterized by a longitudinal depression in the smaller valve; but some of the species enumerated differ so little from one another as to make me doubt the propriety of retaining them all under distinct appellations.

17. *Terebratella dorsata,* Lam. sp., 1819; Sow. Th. Conch. pl. 68. fig. 15, 16, 17.

Hab. Straits of Magelhaens.

18. *Terebratella flexuosa,* King sp., Zool. Journ. vol. v.; Sow. Th. Conch. pl. 69. fig. 23, 24.

Hab. Straits of Magelhaens, in the vicinity of Port Famine.

19. *Terebratella Chilensis,* Brod. sp., 1833; Zool. Proc.; Sow. Th. Conch. pl. 68. fig. 18, 19.

Hab. Bay of Valparaiso, 90 fathoms.

20. *Terebratella Sowerbii,* King sp., 1835; Zool. Journ.; Sow. Th. Conch. pl. 68. fig. 20–22.

Hab. Straits of Magelhaens.

21. *Terebratella Coreanica,* Adam and Reeves sp., 1850, Voy. of the Samarang, pl. 21. fig. 3.

Hab. Corean Archipelago. This species is beautifully strigated with bright red, which distinguishes it from *T. Bouchardii,* which is of a uniform yellow colour.

22. *Terebratella Bouchardii,* Dav. 1852; Zool. Proc.

Hab. Unknown.

23. *Terebratella rubicunda,* Sow. sp., 1846; Zool. Journ.; Sow. Th. Conch. pl. 70. fig. 45, 46, 47.

Hab. Abundant in the seas near New Zealand; its colour is vivid red or white. *T. inconspicua,* Sow., seems to be only a young and ill-grown specimen of this species.

24. *Terebratella Zelandica,* Desh. sp., 1830; Sow. Th. Conch. pl. 72. fig. 111–113.

Hab. Cook's Straits, New Zealand, depth 15 fathoms. This

is the *Ter. sanguinea*, Leach (not Chemnitz), *Ter. rubra*, Sow., by mistake Th. Conch. pl. 68. fig. 9–11, not *T. rubra*, Pallas.

25. *Terebratella crenulata*, Sow. sp., 1846, Th. Conch. pl. 71. fig. 96–98.

Hab. Santa Cruz and Korea. In this species the loop is doubly attached as in all *Terebratellæ*, but the central septum forms an elevated plait almost reaching the larger valve; the form of the loop is similar to that of *T. Evansii*, but slightly different in its details.

26. *Terebratella Evansii*, Dav.; Zool. Proc., 1852.

Hab. New Zealand.

27. *Terebratella Labradorensis*, Sow. sp., Th. Conch. pl. 71. fig. 89, 90.

Hab. Labrador (Goodsir).

28. *Terebratella Algoensis*, Sow. sp., Th. Conch. pl. 71. fig. 91, 92.

Hab. Algoa Bay. Only the larger or perforated valve is known, but by analogy I suppose it to be a *Terebratella*.

29. *Terebratella transversa*, Sow. sp., 1846, Th. Conch. pl. 72. fig. 114, 115.

Hab. Unknown.

30. *Terebratella rubella*, Sow. sp., 1846, Th. Conch. pl. 69. fig. 40, 42.

Hab. Java. Mr. Sowerby states the loop to be simply attached as in *australis*; this however appears to me to be a mistake, as Mr. Cuming has specimens showing traces of the double attachment.

31. *Terebratella*? *sanguinea*, Chemnitz sp., 1785; Sow. Th. Conch. pl. 71. fig. 71, 73.

Hab. Island of Zebu. This species appears to have the loop attached somewhat as in *Megerlia*.

32. *Terebratella Cumingii*, Dav.; Zool. Proc. 1852.

Hab. New Zealand. I am quite at a loss what to do with this form, which possesses many of the characters of *Magas*, *Bouchardia* and *Terebratella*; for the present I therefore leave it under the latter genus, from whence it may be removed if future discoveries render this necessary.

IV. Genus Megerlia, King, 1850.

In this section a slightly elevated medio-longitudinal crest proceeds from under the muscular fulcrum to less than half the length of the valve, near the extremity of which two short central diverging branches arise and support the calcareous loop, which consists of two riband-shaped lamellæ, first attached to the inner side of the socket walls or crural base, afterwards extending to the extremity of the diverging branches to which they are affixed before proceeding on both sides in the same direction to their extremity, under the shape of two nearly parallel longitudinal lamellæ, which are afterwards folded back as in *Terebratula*, forming a loop, but giving off two processes, which affix themselves also to the extremity of the diverging branches above described; perhaps in time it will be found necessary to consider

this genus as a section of *Terebratella*: two recent species of this genus are known, and it occurs in the fossil state.

33. *Megerlia truncata*, Linn. Gmel. sp., 1788; Chem. 1785; Sow. Th. Conch. tab. 71. f. 64–67.

Hab. Coast of Sicily, &c., depth from 60 to 105 fathoms; found fossil at Gibraltar.

34. *Megerlia pulchella*, Sow. sp., 1846, Th. Conch. pl. 71. fig. 105–107.

Hab. Attached to corals at Calapan, Island of Mindoro, &c.

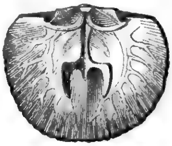
V. Genus Kraussia, Dav. 1852.

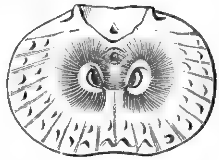
Shell subcircular, with a nearly straight hinge-line; beak truncated; foramen large, round; deltidial plates small, not united; beak ridges well defined, leaving a flat false area between them and the hinge margin; in most species a longitudinal depression exists in the smaller valve; the inferior pedicle muscles are large, leaving two wide eye-shaped impressions close to the hinge, and between the inner walls of the socket ridges, a small slightly elevated mesial ridge extends to about half the length of the valve, at the extremity of which arise two small forked diverging lamellæ expanded at their extremity.

The ciliated arms are unusually small, their fringes not extend-

ing to more than half-way towards the border of the shell; in the first part of their course from the mouth forwards, the cilia are few or wanting; the whole brachial apparatus is supported by the small forked process above described, no other part of the apophysary system being calcified.

Obs. The animal of this genus has been examined in two species, and differs from *Megerlia* in the relative small size of the ciliated arms: five recent species are known.





35. *Kraussia rubra,* Pallas sp., 1766; Mis. Zool. tab. 14. fig. 2, 11; Ency. Méth. pl. 243. fig. 4–8.

Syn. *Anomia striata promontorii bonæ spei*; Chemnitz, 1785, tab. 77. fig. 103.
Anomia Capensis, Gmel., 1788.
Terebratula Capensis, Krauss, 1848.

Hab. Near Cape of Good Hope.

Obs. Most authors have misunderstood this form; Sowerby, in his 'Th. Conch.' tab. 68. figures as *T. rubra* (Pallas), a specimen of *T. Zelandica,* which is now in the Collection of the British Museum, and figured by Leach under the false name of *sanguinea,* which is not Chemnitz's species. *T. Capensis,* Adam and Reeves, is not the *T. Capensis* of Chemnitz, and therefore not the *T. rubra* of Pallas.

36. *Kraussia cognata,* Chemnitz sp., 1785; Sow. Th. Conch. pl. 68. fig. 12–14.

Hab. South Africa.

37. *Kraussia pisum,* Lamarck sp., 1819; Sow. Th. Conch. pl. 69. fig. 37–39.

Ter. natalensis, Küster, 1843; Krauss, 1848.

Hab. Cape of Good Hope.

38. *Kraussia Lamarckiana,* Dav. 1852; Zool. Proc.

Hab. Sidney and New Zealand.

39. *Kraussia Deshaysii,* Dav. 1852; Zool. Proc.

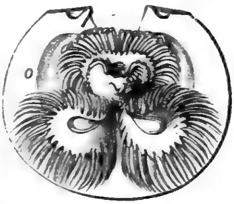
Ter. Capensis, Adam and Reeves (non *T. Capensis,* Gmelin), &c.

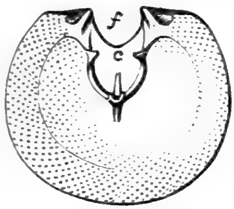
Hab. Korea.

VI. Genus Morrisia, Dav. 1852.

Shell minute, circular, depressed; foramen large, round, encroaching equally on both valves; larger valve with a small straight hinge area; deltidium plates minute, widely separated; smaller valve deeply notched at the umbo; apophysary system consisting of two branches, originating at the base of the dental sockets, and united to a small elevated process arising from the centre of the valve.

Animal furnished with two subspiral or *sigmoid* arms, fringed with comparatively large cilia: these arms originate above the mouth (as shown in the figure) supported by the crural processes, and after passing forwards and converging in front of the mouth they again turn outwards, each having the shape of the letter S.





The shell is of a dark green colour, with bright orange ovaries, contrasting with the brilliant white of the ciliated arms. The cilia (more properly *cirri*) are grouped in pairs, as we believe to be the case in the *Terebratulæ* generally.

40. *Morrisia seminulum,* Philippi sp., Enum. Moll. Siciliæ, 1836, pl. 6. fig. 15.

Ter. depressa, Forbes, Rep. of the Mol. of the Ægean Sea, 1843.

Hab. Mediterranean, depth 95 fathoms (Forbes).

Obs. Philippi's species has been mistaken by Sowerby, who gave the name *seminulum* to another form which we have called *Argiope Forbesii.* The original figures of *seminulum* are circular, and clearly exhibit the deep notch in the umbo of the smaller valve characteristic of the genus, and not to be found in any species of *Argiope*: according to Küster the shell under notice has received the name of *Ter. Neapolitana* from Scacchi, Oss. Zool. ii. p. 18; but not having been able to find the paper alluded to, I have retained Philippi's name.

VII. Genus Magas, Sow. 1818.

The genus *Magas* is characterized by the peculiar shape of its apophysary system, composed of an elevated longitudinal septum in the imperforated valve, to which are affixed two pairs of

calcareous lamellæ differently disposed: the lower pair are riband-shaped, attached first to the crural base. They direct themselves by a gentle curve to near the anterior portion of the septum, to the sides of which they are affixed: the second pair arise on either side of the upper edge of the septum, extending in the form of two triangular-shaped lamellæ.

No true recent Magas has been discovered; but some forms, placed for the present in *Terebratella*, such as *T. Cumingii*, possess characters of this genus.

Subgenus Waltonia.

Apophysary system consisting of a pair of riband-shaped lamellæ fixed to the crural base and to an elevated plate.

41. *Waltonia Valenciennii*, Dav. 1850, Ann. and Mag. of Nat. Hist. vol. v. pl. 15. fig. 1.

Hab. New Zealand.

VIII. Genus Bouchardia, Dav. 1849.

Apophysary system anchor-shaped, consisting of an elevated central plate, to which are affixed two short lamellæ.

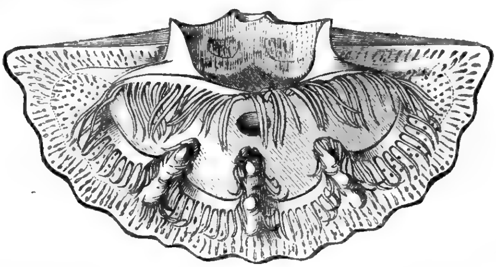
42. *Bouchardia rosea*, Humphrey sp.; Dav. Bull. Soc. Géol. de France, vol. vii. 2nd ser. pl. 1. fig. 1–6, 1849.

Hab. Rio in 13 fathoms.

Obs. Magas, *Waltonia*, and *Bouchardia* are related to *Terebratella* by such species as *Terebratella crenulata*, *Evansii* and *Cumingii*.

IX. Genus Argiope, Deslongchamps, 1842.

Megathyris, D'Orb. 1847.



In the imperforated valve one or more prominent septa; apophysary system consists of a distinct loop, originating at the base of the dental sockets and furnished with converging crural

processes: the loop is folded into two or more lobes occupying the interspaces of the radiating septa, to which they adhere on their inner side. The mantle adheres closely to the shell, as in *Terebratula* proper, and is not seen, except as a part of the shell: its margin is simple and not ciliated; the arms originate as in *Terebratula* on the anterior side of the mouth, and diverge right and left parallel with the margin of the shell, but at some little distance from it: when they arrive at the raised septa they turn inwards, forming one or more lobes on each side of the middle line: the outline of the arms is therefore four-lobed in *A. decollata*; whilst in other recent species, such as *A. cistellula*, which has only one, there is only one lobe to each arm. The arms are relatively connected, as in *Terebratula*, by a membrane filling up the whole interior space.

43. *Argiope decollata*, Chem. sp. 1785; *detruncata*, Gmel. 1788. Sow. Th. Conch. pl. 71. fig. 68, 70.

Hab. Mediterranean: depth from 45 to 105 fathoms; fossil. Miocene, Gibraltar. (James Smith.)

44. *Argiope cuneata*, Risso sp., 1826; Sow. Th. Conch. pl. 70. fig. 83, 84.

Ter. Pera, Mühlfeld.

Hab. Mediterranean: depth from 28 to 69 fathoms (Forbes).

Obs. This species has only a single median septum. The lobes of the loop are free for one half their extent in the specimen examined, and then blend with the shell, as we have noticed in some specimens of *A. decollata*.

45. *Argiope Forbesii*, Dav. 1852.

T. seminulum and *lunifera* of Sow. Th. Conch. pl. 71. fig. 85–88 (non *T. seminulum*, Philippi).

Hab. Mediterranean: depth from 60 to 105 fathoms (Forbes).

Obs. In this form the same longitudinal septum exists, but the loop was imperfect in the specimens at my disposal.

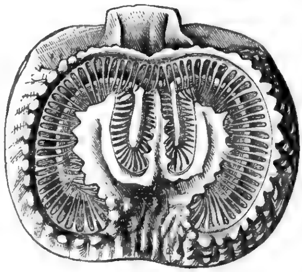
46. *Argiope cistellula*, S. Wood, sp. 1840; Mag. and Ann. of Nat. Hist. vol. v., and Forbes and Hanley, Hist. of Brit. Moll. pl. 57. fig. 9, 1849; Dav. Mon. of Tertiary Brach. Pal. Soc. part 1. p. 10. f. 2.

Hab. Off Skye, Zetland, &c., Scotland; in 40 fathoms (M'Andrew).

Obs. In this species the same mesial septum coexists with a complete two-lobed loop; in my specimen of this species the animal is preserved, and differs only from *A. decollata* in having two lobes instead of four.

X. Genus Thecidea, Def. 1828.

Thecidea has a calcareous loop folded into two or more lobes, and lying in hollows of corresponding form excavated in the substance of the small valve. This loop, or apophysary ridge, supports the branchial membrane, whose thickened and ciliated margin is apparently attached to the inner sides of the grooves. The cilia are very long, especially the outer series, which are directed inwards in the dried specimens.



47. *Thecidea mediterranea*, Risso, 1826; Hist. Nat. des Princ. Prod. de l'Europe Mer. fig. 183; Sow. Th. Conch. pl. 73. fig. 30–32.

Hab. Mediterranean.

2. Family Spiriferidæ (extinct).

Shell furnished with spiral calcareous processes for the support of the oral arms. Usually trilobed and winged.

3. Family Rhynchonellidæ.

Shell not punctate, usually tetrahedral and sharply plaited; oral arms spiral, supported only by short curved processes.

XI. Genus Rhynchonella, Fischer, 1809.

Shell variable in shape; beak acute, more or less recurved, no true area; foramen variable in its dimensions and form, placed under the beak, exposed or concealed, entirely or partially surrounded by a deltidium in two pieces; apophysary system in smaller valve composed of two short flattened and grooved lamellæ separate and moderately curved upward, attached to the inner side of the beak of smaller valve, and to which were affixed the free fleshy arms.

Obs. Not having had the advantage of examining the animal of this genus, I can only refer to Prof. Owen's anatomy of *R. psittacea* in the Zool. Trans. vol. i. 2nd part: two species of recent *Rhynchonellæ* are known.

48. *Rhynchonella psittacea*, Chem. sp., 1785; Sow. Th. Conch. pl. 71. fig. 78, 79, 80.

Hab. Labrador, in the mud on the shore at low water: dredged alive at Melville Island, throughout the arctic seas, from low

water to 100 fathoms: obtained by Prof. King from the depth of 30 fathoms at a distance of twenty-five miles from the northern coast of Northumberland, and by Laskey by dredging in the depths of the Frith of Forth. This species is found fossil in the Norwich Crag, and in the glacial formation of the Clyde.

49. *Rhynchonella nigricans*, Sow. sp., 1846; Proc. of Zool. Soc. and Sow. Th. Conch. pl. 71. fig. 81, 82; also Dav. Zool. Proc. 1852.

Hab. Foveaux Straits, about five miles N.E. of Ruapuke Island, dredged in 19 fathoms by Mr. F. J. Evans, R.N., New Zealand.

Obs. This species is undistinguishable from half-grown specimens of the oolitic *Rh. concinna*, Sow., but probably never became so globular as that species is found, when adult.

4. Family Orthidæ (extinct).

Arms spiral; ? destitute of calcareous supports, attached or not by a pedicle.

5. Family Calceolidæ (extinct).

6. Family Craniadæ and Orbiculidæ.

Shell horny or calcareous, minutely tubular, attached by the ventral valve, or by a pedicle passing through a fissure in it; no hinge or apophysary system; animal with its oral arms fixed to a process of the lower (ventral) valve. The lower valve in both *Crania* and *Orbicula* correspond to the perforated valve of *Terebratula*, so that while those two genera form an exception to the invariable rule that the shell of the Brachiopod is fixed by means of the *ventral* valve, they differ very remarkably from other genera in having the oral arms fixed to the ventral or attached valve.

XII. Genus Crania, Retzius, 1781.

Shell calcareous, tubular; ventral or fixed valve with a central process, to which the spiral arms are attached; dorsal or upper valve free, limpet-like, with two diverging muscular processes. No hinge or calcareous appendage, no perforation for the passage of a pedicle of attachment; arms fleshy.

50. *Crania ringens*, Hœningh., 1828; Sow. Th. Conch. pl. 73. fig. 10, 11.

Hab. Mediterranean in from 40 to 90 fathoms; also near Sidney, New South Wales.

51. *Crania personata*, Lam. 1819; Sow. Th. Conch. pl. 73. fig. 9.

Hab. India.

52. *Crania anomala,* Müll. sp., Zool. Dan. 1776. *C. norvegica,* Sow. Th. Conch. pl. 73. fig. 15–17.

Hab. Scotland, adhering to stones, &c. in deep water in Zetland, in 20 fathoms off Arran, in from 30 to 80 fathoms in Loch Fyne, &c.; also in North Sea.

53. *Crania rostrata,* Hœningh., 1328; Sow. Th. Conch. pl. 73. fig. 12–14.

Hab. Mediterranean.

XIII. Genus Orbicula, Cuvier, 1789.

Shell horny; upper valve limpet-like, without any internal processes; ventral or lower valve perforated for the passage of the pedicle, and furnished with a central process for the attachment of the ciliated arms.

54. *Orbicula lamellosa,* Brod. Zool. Proc. 1833, p. 124; Sow. Th. Conch. pl. 73. fig. 1.

Hab. Coast of Peru.

55. *Orbicula lævis,* Sow. 1818; Trans. Zool. Soc. vol. viii., and Sow. Th. Conch. pl. 73. fig. 2, 3.

Hab. Off Conception, Chili; attached to *Mytili*; depth 6 fathoms.

56. *Orbicula Cumingii,* Brod. Zool. Proc. 1833; Sow. Th. Conch. pl. 73. fig. 6.

Hab. Payta, St. Elena and Panama.

57. *Orbicula strigata,* Brod. Zool. Trans. vol. i. pl. 23. fig. 1, 1833; Sow. Th. Conch. pl. 73. fig. 7.

Hab. Island of Canna, Guatemala, Malacca, &c.

58. *Orbicula striata,* Sow. 1818, Trans. Zool. Soc.; Sow. Th. Conch. pl. 73. fig. 8.

Hab. Unknown.

59. *Orbicula tenuis,* Sow. 1846; Sow. Th. Conch. pl. 73. fig. 4, 5.

Hab. Unknown.

60. *Orbicula Evansii,* Dav. 1852; Zool. Proc. 1852.

Hab. Bodegas.

7. Family Lingulidæ.

Almost equivalved, rudimentary branchiæ developed from the mantle.

XIV. Genus Lingula, Bruguière, 1791.

Shell thin, depressed, almost equivalved, hingeless, the two valves being held together by the adductor muscles; the shell attached by a pedicle which passes between the beaks. No calcareous supports. On each side of the base of the mouth is situated an elongated subspiral fleshy arm, fringed exteriorly with numerous cilia.

61. *Lingula anatina,* Lam. 1819; Sow. Th. Conch. pl. 67. fig. 1–10.

Hab. in sand at low water at the island of Siquijor.

62. *Lingula Hians,* Swains. 1823; Phil. Mag. vol. lxii.; Sow. Th. Conch. pl. 67. fig. 4.

No *habitat* given.

63. *Lingula Audebardi,* Brod. 1833, Zool. Proc.; Sow. Th. Conch. pl. 67. fig. 5.

Hab. In coarse sand at about half-tide from 4 to 6 inches below the surface; at the island of Punam, in the bay of Guayaquil.

64. *Lingula semen,* Brod. 1833, Zool. Soc.; Sow. Th. Conch. pl. 67. fig. 11.

Hab. Off the Isle of Plata, West Columbia.

65. *Lingula tumida,* Reeves, 1841, Proc. Zool. Soc.; Sow. Th. Conch. pl. 67. fig. 7.

Hab. Masbate, New Holland.

66. *Lingula ovalis,* Reeves, 1841, Zool. Proc.; Sow. Th. Conch. pl. 67. fig. 8.

Hab. Sandwich Islands.

67. *Lingula albida,* Hinds, 1844, Moll. Voy. of the Sulphur, p. 71. pl. 19. fig. 4; Sow. Th. Conch. pl. 67. fig. 6.

Hab. Bay of Magdalena, California, in 7 fathoms, among sandy mud.

XXX.—*Notices of British Fungi.* By the Rev. M. J. Berkeley, M.A., F.L.S., and C. E. Broome, Esq.

[Concluded from p. 329.]

[With four Plates.]

640. *S.* (Caulicolæ) *nigrans,* Desm. Ann. d. Sc. Nat. 1846, Pl. Crypt. no. 1774. On *Dactylis glomerata,* Batheaston, Feb. 1851.

In a certain stage of growth the black stroma-like spots are

not visible, but there are merely a few creeping flocci at the base of the perithecia; these gradually increase in number, so as at length to form a thin dark stratum. The species may however be recognized in any state by the fusiform spores, the middle joint of which is swollen. Besides the true paraphyses, there are jointed threads in the perithecia resembling the flocci on some slimy Agarics.

PLATE XI. fig. 27. *a.* Asci; *b.* sporidia in various stages of growth.

641. *S.* (Caulicolæ) *semilibera,* Desm. Pl. Crypt. no. 1787. On dead reeds, Bristol, H. O. Stephens, Esq.

Rather a large form of the species, but such as might be expected on a larger matrix, a circumstance always worthy of attention in this genus, as may be seen in the difference between the same species when growing on a twig, or that luxuriating on a thick bough. The form of the spores is the same. Desmazières' plant is on *Bromus sylvaticus,* but it also grows on *Dactylis glomerata* or *Triticum sativum.*

**S. scirpicola,* Dec. Fl. Fr. ii. p. 809. Besides the common form on *Scirpus,* we find Desmazières' var. *Typharum* on *Typha,* and one similar to it on some *Carex.* In all, the sporidia are oblong, somewhat curved, triseptate, with the articulations slightly swollen.

**S. maculans,* Sow. t. 394. f. 9. Maculis orbicularibus parvis griseis; peritheciis sparsis subglobosis, ostiolis punctiformibus; sporidiis oblongis elongatis curvulis 6–7-septatis. On *Scirpus lacustris.*

This species, which was considered in the 'English Flora' as a form of *S. scirpicola,* we now propose as a species under its original name, being characterized, in addition to its outward appearance, by the sporidia being very much longer and with more than twice the number of septa.

S. maculans, Desm. no. 1784, is totally different.

**S. herbarum, P.,* var. *glumarum.* Peritheciis subglobosis ostiolo papillæformi vel obscuro; ascis clavatis obtusis sporidiis biseriatis fusiformibus curvulis uniseptatis cellulosis. On wheat chaff, Batheaston, Jan. 1850.

Perithecia minute, subglobose, furnished with a more or less visible papillæform ostiolum. Asci large, clavate; paraphyses longer than the asci, flexuous. Sporidia biseriate, yellow-brown, consisting of two apposed cones the border of which is twice constricted, each division containing as seen laterally four cells, so that twenty-four cells are visible in each sporidium.

We were at first inclined to think this distinct from *S. herbarum,* but we have since seen the sporidia of undoubted *S. herbarum* formed on the same principle.

642. *S.* (Caulicolæ) *Ogilviensis,* n. s. Tecta; peritheciis depressis; ostiolo papillæformi; ascis clavatis; sporidiis fusiformibus bipartitis, endochromatibus in quoque loculo tribus. On dead stems of *Senecio Jacobæa,* Dundee, Mr. W. M. Ogilvie.

Perithecia scattered, covered by the cuticle, depressed, with a decided obtuse, papillæform ostiolum. Asci clavate; sporidia biseriate, fusiform, consisting of two apposed cones, the sides of which are slightly hollowed out; each division containing three endochromes.

No species can be confounded with this when the fructification is properly observed. Externally it resembles *S. herbarum.*

Plate XI. fig. 28. *a, b.* Sporidia more or less magnified.

643. *S.* (Caulicolæ) *Clivensis,* n. s. Tecta subglobosa ostiolo minuto perforante; ascis elongato-clavatis; sporidiis oblongis curvulis utrinque obtusis triseptatis fuscis. On dead stems of some herbaceous plant, apparently *Pastinaca sativa,* in an old stone pit at King's Cliffe, July 1850. It will probably prove common, but the name is intended to indicate the place where it first occurred. Entirely covered, with the exception of the minute ostiolum which penetrates the cuticle.

Perithecia subglobose. Asci clavate, elongated; sporidia biseriate, oblong, slightly curved, very obtuse, triseptate; sometimes constricted at the articulations, dark brown.

Allied to *S. herbarum,* but with very different sporidia. We can find no indication, in authors, of this species, whose fruit is extremely beautiful.

Plate XI. fig. 29. *a.* Ascus; *b.* sporidia more or less magnified.

644. *S.* (Caulicolæ) *modesta,* Desm. Pl. Crypt. no. 1786. On dead stems of *Scrophularia,* Glen Isla, Mr. W. Gardiner, May 1846 (no. 131).

M. Desmazières' specimens are on *Scabiosa.* The peculiar character is the swelling out of the third joint of the curved, multiseptate, subfusiform sporidia. In *S. complanata* the sporidia are larger, with the second joint swollen, as in Libert, no. 244. *S. complanata,* Desm. no. 713, appears exactly intermediate between the two; in this we find the third joint swollen. In both, the asci are cylindrical, but they are clavate in *S. modesta.* In Fries' 'Scl. Suec.' we find in one copy *Phacidium Patella,* and in another which exactly resembles Madame Libert's plant externally, there are no asci, but slender fusiform spores, seated on sporophores, which must either be considered as a *Septoria,* or as the Sphæropsoid form of the species.

The swollen joint in this and several other species may

possibly be something analogous to the phænomena exhibited by *Vesiculifera*.

PLATE XI. fig. 30. Sporidium highly magnified.

645. *S.* (Caulicolæ) *commanipula*, n. s. Sparsa primum subglobosa tecta demum denudata collapsa ostiolo minuto; ascis cylindricis; sporidiis biseriatis brevibus elliptico-cymbiformibus uniseptatis. On the dry capsules of some *Scrophularia*, Glen Isla, Forfarshire, May 1846, Mr. W. Gardiner.

Scattered, at first covered by the cuticle, subglobose, then exposed and collapsed, with a minute papillæform ostiolum, which is however sometimes obscure. Asci cylindrical; sporidia biseriate, elliptico-cymbiform, uniseptate. Sometimes one of the endochromes is decidedly conical, with a constriction about the centre.

This occurs on the capsules of the same plant whose stems produced *S. modesta*. On the capsules we also find a *Phoma*, precisely similar externally, which may be regarded possibly as the Sphæropsoid form of the species.

PLATE XI. fig. 31. *a.* Ascus; *b.* sporidia: both more or less magnified.

646. *S.* (Caulicolæ) *Thwaitesii*, n. s. Peritheciis minutis convexis basi applanatis; mycelio subtilissimo matricem intrante æruginoso; ascis cylindricis; sporidiis oblongo-clavatis curvulis obtusis; endochromatibus 4 repletis. On stems of *Umbelliferæ*, Leigh Wood, Bristol, G. H. K. Thwaites, Jan. 1845.

Perithecia minute, convex above, flattened below, arranged in short lines; seated on the woody fibres, which are traversed and covered with very delicate anastomosing, verdigris-green threads. Asci cylindrical or subclavate, rather short; sporidia biseriate, oblongo-clavate, obtuse at either extremity, slightly curved, containing about four endochromes. In some specimens we find naked, oblong, slightly curved spores, with about five endochromes, the whole gelatinous mass having a pale sea-green tint. The æruginous threads running through the hyaline woody fibres and anastomosing in their cavity form a very pretty object under the microscope.

On the same stem a *Peziza* occurs, externally resembling *P. atrata*, but with elongated, oblong, curved sporidia, containing 7–9 endochromes.

PLATE XI. fig. 32. *a.* Sporidia; *b.* mycelium; *c.* one of the woody cells traversed by mycelium. All more or less magnified.

647. *S.* (Caulicolæ) *Phomatospora*, n. s. Immersa; peritheciis depressis ellipsoideis ostiolo papillæformi; ascis linearibus; sporidiis uniseriatis oblongo-ellipticis minutis hyalinis binucleatis. On dead potato stalks, Ashwick, Gloucestershire, March 1850.

Immersed in the dead decorticated stems, and, with the exception of the black punctiform ostiolum, quite invisible, being concealed by the woody tissue. Contents of the perithecia pale salmon-coloured. Asci extremely delicate, linear; sporidia hyaline, uniseriate, oblongo-elliptic, minute, obtuse, with a single nucleus at either extremity.

Agreeing in habit with *S. Berkeleyi*, Desm., like which it is not merely subcuticular or cortical. It differs essentially in its depressed perithecia, shorter ostiolum, and more especially in its shorter obtuse sporidia, which closely resemble those of a *Phoma*.

Plate XI. fig. 33. *a*. Ascus; *b*. sporidia. Both more or less magnified.

A *Sphæria* occurs on leaves of *Aira cæspitosa* at Batheaston, with slightly longer sporidia and more exposed perithecia, which we at first referred to this as a variety. As it grows on leaves the perithecia are necessarily less immersed, and the difference in the sporidia is very slight. We are now inclined to consider it rather as a form of *S. phæosticta*.

648. *S.* (Caulicolæ) *tosta*, n. s. Peritheciis minutis pallidis depressis epidermide adusta tectis; ascis linearibus; sporidiis uniserialibus; sporidiis brevibus elliptico-cymbiformibus uniseptatis. On dead stems of *Epilobium hirsutum*, Rudloe, Wilts, Feb. 1843.

Perithecia depressed, subglobose, pale, concealed under broad spots which look as if they had been scorched, the part of the cuticle above each perithecium being darker. Asci linear; sporidia uniseriate, short, elliptico-cymbiform, uniseptate, very pale. This species has somewhat the habit of *S. tomicum*, *S. clypeata*, &c., but is very distinct.

Plate XI. fig. 34. *a*. Ascus; *b*. sporidia. Both more or less magnified.

649. *S.* (Caulicolæ) *tenebrosa*, n. s. Sparsa tecta epidermide prosenchymateque tenebrosis; peritheciis depressis; ascis amplis cylindrico-clavatis; sporidiis fuscis bipartitis articulis subconicis endochromatibus binis repletis. On dead stems of *Arctium*, which are completely blackened by the fungus, King's Cliffe, May 1, 1843.

Perithecia scattered, irregularly covered by the cuticle and subjacent cells which are traversed by dark cellular mycelium, which here and there gives rise to short Toruloid threads. Asci large, cylindrical, obtuse, slight, attenuated below; sporidia biseriate, composed of two apposed irregular cones which contain at first a single large globule, but at length have two irregular endochromes.

A very fine species remarkable for its curious mycelium and

large sporidia. The perithecia are by no means seriate, and the connecting cellular matter can scarcely be considered a stroma. The sporidia are totally different from those of *S. inquilina,* with which the species may perhaps be compared.

PLATE XII. fig. 35. *a.* Asci and paraphyses; *b.* sporidium; *c.* mycelium. All more or less magnified.

**S. nigrella,* Fr. Obs. i. t. 4. fig. 2. On *Angelica sylvestris,* King's Cliffe.

We have exactly similar specimens from the south of France, gathered by Dr. Montagne, and which had been submitted to the inspection of Fries.

650. *S.* (Foliicolæ) *sabuletorum,* n. s. Sparsa tecta; peritheciis subglobosis demum collapsis ostiolis pertusis; ascis amplis cylindricis sporidiis fusiformibus nodulosis. On dead leaves of *Ammophila arundinacea,* Sands of Barrie, Mr. W. Gardiner, May 1845.

Perithecia scattered, concealed, with the exception of the pertused ostiolum, subglobose, at length collapsed. Asci large, rather short, cylindrical, very obtuse. Sporidia at first globose or obovate, uniseptate; eventually one joint produces three endochromes and the other four, the fourth being seated in the centre of the compound fusiform sporidium, and much larger than the rest. There is a constriction between each endochrome. Other sporidia may be found more or less distorted; sometimes a partial disruption takes place at the primitive articulation, and the axes of the two portions make an obtuse angle with each other. In the young spores the centre of the dissepiment is often thrust forward into one of the cells, generally the larger, so as to call to mind the analogous phænomenon in *Zygnemata.* This is perhaps the finest of all the graminicolous species.

This species occurs on the specimens published under No. 1288 by M. Desmazières as *S. perforans,* Roberge. The sporidia of that species are described as elliptic, bilocular and hyaline. We do not find that species on the grass, but the present and three other genera, amongst which is our *Eriospora,* which does not appear hitherto to have been observed in France.

Since the above was written, we have received a specimen of *S. perforans* from M. Desmazières which contains fruit agreeing with his description, and unmixed with our *S. sabuletorum,* which cannot be distinguished without microscopical examination. There is a certain resemblance in the very early state of the sporidia, but *S. perforans* stops where *S. sabuletorum* begins. Amongst the specimens of *Ammophila* studded with Cryptogams, received from Mr. Gardiner, is a minute lichen, apparently *Biatora vernalis* (*Lecidea sabuletorum,* Moug. and Nest.), which exhibits conidia seated on the tips of the paraphyses. Something

of the kind is figured by Bayrhoffer, Einiges über Lichenen, t. 3. f. 12. See also Gardeners' Chronicle, Dec. 20, 1851. The apical spores in *Lichenopsis* of Schweinitz are evidently of the same nature.

PLATE XII. fig. 36. *a.* Ascus; *b.* young sporidia; *c.* older; *d.* young sporidium showing the bulging septum; *e.* sporidia (sometimes appendiculate) from *S. perforans*, Roberge. Fig. 37. Paraphyses of lichen bearing conidia. All more or less magnified.

651. *S. phæosticta*, Berk. in Antarct. Fl. Crypt. p. 59. tab. 68. fig. 4. On *Carex pendula*, Thornhaugh, Norths.

The antarctic specimens are on *Hierochloe Brunnoniensis*. The sporidia are brown, and resemble those of *S. fusca*.

PLATE XII. fig. 38. *a.* Ascus; *b.* sporidia. Both more or less magnified.

652. *S.* (Foliicolæ) *eucrypta*, n. s. Tecta; peritheciis ovatis teneris, e floccis sparsis ramosis enatis; collo brevissimo; ascis clavatis; sporidiis lineari-fusiformibus; endochromatibus pluribus inæqualibus. On leaves of *Carex pendula*, Batheaston, Jan. 1850.

Scarcely visible unless the leaf is held up to the light; perithecia delicate, ovate, with a very short neck and round aperture like a little India-rubber bottle, springing from threads which are mostly branched at right angles. Asci very delicate, clavate; sporidia $\frac{1}{300}$th of an inch long, lineari-fusiform, with several endochromes varying much in size.

A pretty species, but very liable to be overlooked, unless the leaves on which it grows chance to be saturated with moisture.

PLATE XII. fig. 40. *a.* Asci; *b.* sporidia; *c.* threads accompanying the perithecia, and with which they are partially clothed.

653. *S.* (Foliicolæ) *helicospora*, n. s. Tecta; peritheciis subglobosis; ascis clavatis; sporidiis linearibus longissimis spiraliter involutis. On leaves of *Cyperaceæ*, West of England.

Distinguished from the former by its extremely long spirally disposed sporidia, which resemble those of *Hysterium apiculatum*.

654. *S.* (Foliicolæ) *palustris*, n. s. Tecta; peritheciis globosis; ostiolo minuto papillæformi, ore tandem rotundo aperto. Ascis linearibus. Sporidiis ellipticis curvulis uniseptatis utrinque appendiculatis. On dead leaves of *Iris, Carex,* &c., Batheaston, Dec. 1849.

Scattered, completely covered by the cuticle, globose at first, with a minute papillæform ostiolum, at length opening with a regular round aperture, the edges of which adhere closely to the matrix. Asci linear; sporidia uniseriate or rarely biseriate from slipping over each other, cymbiform, brown, uniseptate, furnished at either end with a hyaline appendage rather shorter than the

joints, at length ejected and forming a brown border to the ostiolum. Sometimes the two cells of the sporidia appear like two apposed cones. The appendages seem to be continued from a delicate outer membrane, and sometimes both point in one direction, sometimes in two, so as to give the sporidia a sigmoid outline.

PLATE XII. fig. 39. *a.* Ascus; *b.* sporidia. Both more or less magnified.

**S. Artocreas,* Tode = *Discosia clypeata,* De Notaris. We have also from Aberystwith, gathered by Mr. Ralfs, and from Appin by Capt. Carmichael, a species of *Pilidium,* which does not differ, as far as we can see, from *P. disseminatum,* Lib., a synonym we believe of *P. acerinum,* Kze. Our plant occurs on oak leaves.

655. *S.* (Foliicolæ) *carpinea,* Fr. Syst. Myc. vol. ii. p. 523; Desm.! no. 981. On dead leaves of hornbeam, Lucknam, Wilts.

Asci subclavate; sporidia biseriate, broadly and shortly cymbiform, the least curved side being a little hollowed out towards either apex.

PLATE XII. fig. 41. *a.* Ascus; *b.* sporidia. Both more or less magnified.

656. *S. Pteridis,* Desm. Pl. Crypt. no. 1295. *S. Litura,* Berk. MSS. (olim). "Epiphylla maculis parvis griseis vel nullis; peritheciis minutis globosis sparsis vel subaggregatis, epidermide tectis; ascis clavatis."

= *S. punctiformis,* b. Pteridis, Fr. Scl. Suec. no. 86.

**S.* (Foliicolæ) *Brassicæ* = *Asteroma Brassicæ,* Chev. Par. vol. i. p. 449.

Nothing can be more common than this on cabbage-leaves in autumn and spring, but it is not often found with perfect fruit, which places its true characters beyond doubt.

PLATE XII. fig. 42. *a.* Asci; *b.* sporidia. Both more or less magnified.

657. *S. Eryngii,* Fr. in Duby, Bot. vol. ii. p. 710; Desm.! Pl. Crypt. de France, no. 1300. On dead leaves of *Eryngium,* Penzance, J. Ralfs, Esq.

658. *S.* (Foliicolæ) *Rumicis,* Desm. Pl. Crypt. no. 1298. *S. lichenoides,* Johnst. Fl. Berw. vol. ii. p. 131. "Maculis amphigenis, minutis, numerosis, orbiculatis, sparsis, brunneis, viridulo-cinctis. Peritheciis epiphyllis, conglomeratis, innato-prominulis, perexiguis, globoso-depressis, collabescendo concavis, olivaceis, dein nigris, poro simplici pertusis. Ascis amplis, tubulosis, parum curvatis. Sporidiis olivaceis ovato-oblongis obtusis uniseptatis."

Abundant on dock-leaves, Twycross, Rev. A. Bloxam; Berwick, Dr. Johnston; Penzance, J. Ralfs. Esq.; Bristol, H. O. Stephens, Esq.

659. *S.* (Foliicolæ) *Leightoni,* n. s. Epiphylla; peritheciis subglobosis piceis ostiolo conico; ascis clavatis; sporidiis oblongo-cymbiformibus triseptatis. On dead leaves of *Linnæa Borealis,* Glen Dole, Clova, Rev. W. A. Leighton, Aug. 1837.

Minute, scattered over the upper surface of the leaves, pitchy brown, shining, narrowed into a short conical ostiolum. Asci clavate, sublanceolate; sporidia oblongo-cymbiform, about four times as long as broad, obtuse, scarcely curved; endochrome at first retracted to either end; a septum is then formed between the two masses which are at length again divided.

Plate XII. fig. 43. *a.* Ascus; *b.* sporidia. Both more or less magnified.

660. *Dothidea Piggotii,* n. s. Orbicularis innata, superficie cellularum apicibus papillata; ascis brevibus clavatis; sporidiis biserialibus obovato-cymbiformibus 3-septatis. On *Parmelia saxatilis,* Beddgelert and Capel Curig, Aug. 1849, H. Piggot, Esq.

Forming little patches about a line broad, completely adnate with the thallus; surface opake, black, papillate with the protruding tips of the semi-immersed cells, whose walls are black, but separated from each other by pellucid vertical cells running down below into hyaline subhexagonal cells with thick walls. Asci short, broad, subclavate. Sporidia brown, biseriate, obovate, cymbiform, slightly curved, triseptate, or very rarely quadriseptate.

This appears clearly to be of the same category with *D. Lichenum,* which has however, according to Fries, a different outward aspect and very slender asci. We take this opportunity of describing a magnificent closely allied species, gathered in Central America by Mr. Seeman, and now in the herbarium of Sir W. J. Hooker.

Dothidea hymenicola, n. s. Cellulis semiliberis totam superficiem hymeninam occupantibus granulatis, ostiolo subradiato; ascis subcylindricis; sporidiis biseriatis oblongis brevibus uniseptatis. On the apothecia of some species of *Sticta,* Central America.

Occupying the whole surface of the apothecia, which it renders rough and granular like some pustular *Sphæria.* Cells half immersed, their upper half very obtuse, minutely granulated; ostiolum obscurely radiated. Asci subcylindrical, clavate; sporidia biseriate, oblong, uniseptate.

The matter between the cells is composed, as in the last, of longitudinal tissue passing into hexagonal. A state of that species however occurs in which the cells are entirely submersed, without any hyaline tissue interposed between them. As they contain only imperfect fruit, without any distinct asci or spores, we are inclined to think this arrested in its development and

completely charred by the sun. *D. Lichenum*, Fr., is probably more nearly allied to *D. hymenicola*, but in the absence of all information as to the sporidia, it is impossible to speak positively.

661. *Dothidea Johnstoni*, n. s. Maculis minutis orbicularibus; cellulis concentricis semiliberis, ascis brevibus; sporidiis obovato-oblongis uniseptatis. On the leaves of a small *Epilobium*, Berwick, Dr. Johnston.

Forming little black spots about a line broad studded with concentric half-free cells with a little round aperture; there are sometimes a few scattered short stiff brown hairs on the surface, occasionally converging over the orifice. Asci short, subcylindrical, generally rather thicker below. Sporidia biseriate, obovate-oblong, at length pale brown, uniseptate.

Dothidea Epilobii is totally different, and there is no other species with which it can be compared. It has almost the habit of a *Depazea*, or rather of *Sphæria Rumicis*.

**Lasiobotrys Loniceræ*, Sprengel MSS.; Kze. Myc. Hefte ii. p. 88.

After a very careful investigation of this genus, we are enabled to confirm the observations of Dr. Montagne, adding however a little to what he has seen. It is to the specimens published by Desmazières, no. 957, that we are indebted principally for our information. We have distinctly observed the small bodies found at the base of the larger sclerotioid grains pullulating from them, as seen in our sketch. One or two of the outer cells swell, and become filled with a few hexagonal thick-walled vesicles. As the cells increase in size the included tissue is multiplied, and the external wall becomes reticulated, exactly after the fashion of the transformation of a cell in the genus *Antennaria* into a sporangium. The bodies now separate from the original parent. At an early stage when squeezed, a loose gelatinous mass of slightly branched, subcylindric, short, thickish threads makes its appearance. At a later period they are filled with well-formed cylindrical, short, thick asci, which may sometimes be found connected together at the base as if derived from a common thread, of which the structure observed in an earlier stage of growth is doubtless an indication. A sketch communicated by Dr. Montagne exhibits a structure just intermediate. We have not found sporidia, but the asci are as perfect as in *Sphæria herbarum*, and as well developed with a distinct second membrane. This seems to favour M. Desmazières' view of the larger bodies being a sclerotioid stroma. Vertical sections of these bodies when mature, and accompanied by their ascigerous offspring, show very clearly that the asci are truly contained in the smaller sacs, which are therefore the true perithecia. All doubt as to their origin is removed by the discovery of the mode of their production. The

sporidia are still a desideratum; and should it turn out that the bodies observed in the smaller perithecia by Kunze and Montagne are not young asci, though we believe them to be so, we shall then be obliged to regard them as the Sphæropsoid form of the truly ascigerous sacs. Dr. Montagne, it should be observed, has, like ourselves, found undoubted asci in the small perithecia, of which he has sent us numerous sketches.

Plate XII. fig. 44. A transverse slice of one of the large sclerotioid bodies, showing the conversion of the external cells into perithecia. Highly magnified. See also Gardeners' Chronicle, Dec. 6, 1851.

XXXI.—*On some genera of the* Icacinaceæ. By John Miers, Esq., F.R.S., F.L.S.

[Continued from p. 226.]

Apodytes.

The characters of this genus, suggested by Dr. Meyer, were first published by Dr. Arnott in 'Hooker's Journal of Botany,' and nearly about the same time by Mr. Bentham, in a memoir given in the 18th vol. of the 'Linnæan Transactions.' The principal feature by which it is distinguishable from *Icacina*, is the subsequent growth of its ovarium into a form so extremely gibbous, that the style appears as if it were produced upon one side, where it is inflected downwards, and at maturity this is rendered manifest by the presence of a somewhat lateral scutelliform appendage, towards the summit of the fruit. It is however to be remembered, that nothing is yet known of the development of the ovarium of *Icacina*, beyond its early stage, when it exactly resembles that of *Apodytes*; and it is not at all improbable, that in the respect just mentioned, they may turn out to be alike, in which case the two genera must be regarded as identical, and all the species of *Apodytes* must then be referred to *Icacina*. I have had no opportunity of examining the seed of *Apodytes*, and in the following diagnosis have therefore added its carpological characters from the description of Mr. Bentham, which will be seen to conform with the analysis given by Dr. Wight, in his 'Icones,' tab. 1153. The only other tangible feature that can serve to distinguish these genera, is, that in *Icacina* the anthers are ovate, not long, linear, and profoundly bifid below, and that the filaments are slightly induplicated at their apex, not straight, as in *Apodytes*.

Apodytes, E. Meyer; Arnott, Hook. Journ. Bot. iii. 155; Benth. Linn. Trans. xviii. 683.—*Flores* perfecti, vel interdum

polygami, sicco nigrescentes. *Calyx* parvus, 5-dentatus, persistens. *Petala* 5, linearia, carnosula, glabra, hypogyna, æstivatione valvata, demum patentia. *Stamina* 5, cum petalis inserta, iis alterna, et fere æquilonga: *filamenta* compressa, subulata, erecta; *antheræ* lineari-oblongæ, 2-lobæ, basi ad medium bifidæ, in sinu dorsifixæ, sæpe glandulis resinosis asperæ, lobis parallelis, connectivo tenuissimo connatis, singulatim 2-locellatis, demum septicidis et longitudinaliter evolutim dehiscentibus. *Pollen* trigonum. *Ovarium* liberum, oblongum, valde gibbum, disco parvo suffultum, 1-loculare; *ovula* 2 juxta apicem loculi subcollateraliter superposita, podospermio crassiusculo suspensa, anatropa. *Stylus* elongatus, subulatus, flexuosus. *Stigma* clavatum, sub-3-lobum. ("*Drupa* baccata, dimidiato-ovato-reniformis, stylo hinc coronata, et lateraliter appendice carnoso aucto, nucleo osseo monospermo. *Semen* pendulum, ovato-reniforme, compressum, *testa* tenui, *albumine* copioso, carnoso, nigro. *Embryo* in medio albuminis parvus, axilis, juxta hilum positus, rectus, *radicula* breve ad hilum spectante." Benth. *loc. cit.*)—Arbores *capenses et Asiaticæ*, folia *alterna, ovata, integra, coriacea, glabra, petiolata.* Inflorescentia *paniculata, terminalis*; flores *parvuli, cum pedicellis brevibus articulati*, bracteolis *minimis, caducis.*

1. *Apodytes dimidiata*, E. Mey.; Arnott, Hook. Journ. Bot. iii. 155; Benth. Linn. Trans. xviii. 684;—ramulis sulcato-angulatis, junioribus pubescentibus; foliis ovatis vel oblongis, acutis vel retusis, coriaceis, supra glaberrimis, subtus pube rara conspersis, margine cartilagineo revolutis, petiolo subbrevi, canaliculato; paniculis axillaribus et terminalibus, valde ramosis, creberrime floribundis, antheris linearibus, profunde bifidis, crustaceis, glanduloso-echinatis, ovario flavide sericeo. —C. B. S. ad Krakakamma, Prov. Uitenhage (Zeyher, Drège, Harvey); Port Natal (Krauss, 95).

The different specimens vary in the size and shape of the leaves, and in their more or less glaucous or pruinose hue; they are generally from $1\frac{1}{2}$ to $2\frac{1}{4}$ inches long, $\frac{3}{4}$ to 1 inch broad, on a petiole of 3 lines in length.

Var. *β. capensis*;—foliis utrinque acutioribus, glauco-pruinosis, glaberrimis, crasso-coriaceis, margine cartilagineo revolutis, petiolo quam præcedenti duplo longiore et tenuiori, subscabrido.—C. B. S. (Masson); Uitenhage (Drège).

I can hardly affirm this to be a distinct species, although it is very different in its aspect, and remarkable for the much greater length of its petioles; the leaves are more glaucous, thicker, and more coriaceous, upon petioles twice as long, with

longer, spreading, terminal panicles and very copious flowers: the leaves measure generally 2 inches in length, 1 inch in breadth, upon a petiole of 7 lines long.

2. *Apodytes Benthamiana*, Wight, Icones, tab. 1153;—ramulis teretibus, glabris; foliis oblongo-ellipticis, utrinque obtusis, coriaceis, glaberrimis; panicula terminali, rigida, folio breviori, alabastris oblongis, floribus albidis; drupa ovata, appendice laterali scutiformi signata.—Neilgherries.

Dr. Wight describes this to be a tree, with leaves from $3\frac{1}{2}$ to 4 inches long, including the petiole, and $1\frac{1}{2}$ inch broad: the flower-buds 3 lines long: the drupe is represented as 8 lines long, and 6 lines in diameter, semi-ovate, reniform, crowned with the persistent style, and furnished with a lateral scutelliform appendage. The leaves and flowers of this and the following species become dark in drying, and appear to be charged with resinous matter.

3. *Apodytes Gardneriana*, n. sp.;—foliis sicco nigrescentibus, oblongis, utrinque acutis, acuminatis, apice barbato obtuse mucronatis, subcoriaceis, glaberrimis, supra lucidulis, nervis immersis, subtus ferrugineo-brunneis, nervis prominulis rubentibus, margine valde revoluto; panicula sublaxa, terminali, alabastris elongatis, minoribus.—Ceylon, ad Newer-Ellia, altit. 6000 ped. (Gardner, n. 189).

This species hardly accords with Dr. Wight's description of the Neilgherry plant, and the specimens from the two localities differ much in appearance: the leaves here are larger, being $4\frac{1}{4}$ inches long, or with the petiole $4\frac{3}{4}$ in length, and $2\frac{1}{4}$ inches broad; the panicle is $1\frac{3}{4}$ inch long, the flowers grow black in drying, and the buds scarcely exceed a line in length*.

4. *Apodytes acutifolia*, Hochst.;—arbor grandis, ramulis substriatis, glanduloso-verrucosis, foliis ovatis, utrinque acutis, apice repente et breviter attenuatis, glaberrimis, supra sublucidis, subtus pallidioribus, petiolo valde elongato, tenui, canaliculato, glabro, glauco; panicula laxe ramosa, terminali, folio breviore, pauciflora, sparse pubescente.—Abyssinia, in Monte Aber, prope Adesselam altit. 8000 ped.—*v. s. in herb. Hook. et Mus. Brit.* (Schimper, 1315).

This is said by Schimper to be a tall handsome tree: its branchlets are marked with long whitish spots having a furrow down the middle; the leaves are $3\frac{1}{2}$ inches long, $1\frac{3}{4}$ inch broad, upon a petiole $1\frac{1}{4}$ inch in length: the panicle measures $1\frac{3}{4}$ inch.

* A representation of this species with generic details will be given in plate 5 of the 'Contributions to Botany,' &c.

Rhaphiostylis.

This genus, suggested by Dr. Planchon, was first announced by Mr. Bentham, who gave an outline of its characters in the 'Niger Flora,' p. 259. It differs little from *Apodytes*, its distinguishing features consisting in its inflorescence, with small axillary fasciculate flowers, and the peculiar somewhat lateral glandular appendage, seen on the summit of the ovary, and near the base of the style: it bears somewhat the appearance as if it had originally possessed three styles, one of which had acquired much growth, and the other two, being abortive, exhibited only rudimentary traces of their existence: on the other hand, this process is evidently very analogous to the fleshy scutelliform appendage seen in *Apodytes*, as well as to the large epigynous gland observed in the fruit of *Stemonurus*. In its elongated slender style (whence its generic name is derived) it has much resemblance to *Icacina*: in its inflorescence and habit, it bears greatly the appearance of the *Phlebocalymna* of Griffiths. The following outline of its generic character is somewhat modified from that given by Mr. Bentham, in order to distinguish it more readily from other genera of the same family.

Rhaphiostylis, Planch.; Bth. (Flor. Nigrit.)—*Flores* perfecti. *Calyx* breviter campanulatus, 5-dentatus, dentibus obtusiusculis, persistens. *Petala* 5, æqualia, linearia, glaberrima, hypogyna, æstivatione valvata, sub anthesi reflexa. *Stamina* 5, cum petalis inserta, iisdem alterna; *filamenta* carnosula, imo dilatata, apice subulata; *antheræ* oblongæ 2-lobæ, 4-loculares, imo bifidæ, connectivo tenui, dorso in sinu affixæ, lobis singulatim 2-locellatis, demum septicidis, et longitudinaliter evolutim dehiscentibus. *Pollen* trigonum. *Ovarium* oblongum, liberum, subgibbum, glabrum, disco parvulo stipitatum, appendice glanduloso dentibus 2 obtusis erectis ad basin styli lateraliter coronatum, 1-loculare; *ovula* 2 juxta apicem loculi subcollateraliter superposita, podospermio crassiusculo suspensa. *Stylus* tereti-subulatus, gracilis, longitudine petalorum excedens, apice inflexus. *Stigma* obtusum, lateraliter sulcatum. *Fructus* ignotus.—Frutices *Africæ tropicæ glabri, exsiccatione nigrescentes*; folia *alterna, elliptica, integerrima*, flores *parvi, plurimi, axillares, fasciculati, cum pedicellis brevibus articulati.*

1. *Rhaphiostylis Beninensis*, Planch.; Hook. Flor. Nigrit. 259. tab. 28. Apodytes Beninensis, *Hook. fil. Icon. pl.* tab. 778;—glaberrimus, foliis distichis, elongato-ellipticis, utrinque attenuatis, summo obtusiusculo vel emarginato, subtus nervis prominulis, margine revolutis, breviter petiolatis: floribus axillaribus, paucis, virente-albidis, cum pedicellis sub-brevioribus articulatis.—Cape Palmas (Vogel).—*v. s. in herb. Hooker.*

The leaves here are $3\frac{1}{2}$ to 4 inches long, $1\frac{1}{8}$ inch broad, on a petiole of 2 lines; the axils are generally $\frac{3}{4}$ inch apart, with about eight flowers in each; the flowers in bud are 3 lines long, on a pedicel of 2 lines.

2. *Rhaphiostylis Heudelotii*, Planch. MSS.;—glaberrimus, foliis oblongo-ellipticis, utrinque acuminatis, apice repente angustatis, coriaceis, subtus pallidioribus, breviter petiolatis; floribus axillaribus, pedicellatis, e nodo crebre bracteato 8–10-fasciculatis.—Senegambia (Heudelot, 723 : *v. s. in herb. Hook.*).

This is certainly a distinct species, the leaves being considerably larger than the former, more attenuated in the apex, paler, more coriaceous, the axils more distant, and the flowers larger. The leaves are $5\frac{1}{2}$ inches long, 2 inches broad, on a petiole of 3 lines: the axils are $1\frac{3}{8}$ inch apart; the flowers in bud measure 4 lines in length, and 1 line in diameter, upon pedicels 2 lines long; the pistil is at least a line longer than the petals; the calyx is very small: the whole plant is entirely glabrous, and like the former blackens in drying*.

Leretia.

This genus, although previously known from the rough and very incorrect figure in the 'Flora Fluminensis,' was first described by Mr. Bentham in the 'Linn. Trans.' xviii. p. 680. It resembles his *Pogopetalum* in having its petals clothed inside with long silky hairs, and bears some analogy with *Rhaphiostylis* and *Pennantia* in exhibiting two erect processes about the base of the style, which in all these instances may be considered as additional and rudimentary styles, corresponding with as many abortive cells of the ovarium: this hypothesis is rendered the more probable by the fact, that in making a transverse section of the ovarium, these abortive cells may be distinctly traced in the fleshy covering, upon the side correlative with the stylar appendages. As in the other genera last mentioned, the suspension of the two somewhat collateral ovules is from a point below the apex, towards the side of the abortive cells, and they are here attached to a thick fleshy bell-shaped podosperm with a conspicuously crenated margin. The ovarium is densely covered with long adpressed erect hairs, which as well as those of the petals are thickly spotted with prominent, oval, transparent glands, arranged in closely spiral lines all over their surface. I did not meet with its fruit, nor have I found it in any herbarium, so that I cannot offer any particulars of its seminal struc-

* This species, with an analysis of its floral structure, will be represented in plate 6 of the 'Contributions to Botany,' &c

ture; but in the figure of the 'Flora Fluminensis,' above referred to, this is represented as a large fleshy drupe, about $1\frac{1}{2}$ inch in diameter, and therefore one of the largest known in this family. The *Emmotum fagifolium* of Desvaux, from Guiana, has been referred here by Endlicher; but, notwithstanding the scantiness of the details given of it, little doubt can exist that it is identical with the *Pogopetalum acutum*, Bth., also from Guiana.

Leretia, Velloz.—*Flores* perfecti, interdum polygami. *Calyx* breviter campanulatus, acute 5-dentatus, persistens. *Petala* 5, æqualia, hypogyna, oblonga, carnosula, extus pubescentia, intus dense sericea, æstivatione valvata, sub anthesi reflexa. *Stamina* 5, cum petalis disco inserta, iisdem alterna; *filamenta* carnosula, basi dilatata, apice subulata et breviter induplicata; *antheræ* oblongæ, apice mucronatæ, imo breviter bifidæ, 2-lobæ, connectivo tenui dorso infra medium sinu affixæ, lobis bilocellatis, membranaceis, demum septicidis et longitudinaliter evolutim dehiscentibus. *Pollen* ovale, longitudinaliter 3-sulcatum. *Ovarium* conico-oblongum, subgibbum, sericeo-hirsutum, disco parvulo obsolete 5-lobo breviter stipitatum, 1-loculare; *ovula* 2 juxta apicem loculi collateraliter superposita, *podospermio* crasso crenato suspensa. *Stylus* erectus, filiformis, apice inflexus, basi processubus 2 brevibus erectis comitatus, in flore sterili valde brevior, hirsutus et obtusus. *Stigma* obliquum, sulcatum. *Drupa* majuscula, globosa, monosperma; *cætera* ignota. Arbuscula Brasiliensis *in sylvis maritimis vigens*, ramulis *glanduloso-rugosis, acute angulatis, angulis ab axillis utrinque decurrentibus*: folia *alterna, oblonga, glaberrima, subcoriacea, reticulata, minute pellucido-punctulata, læte viridia, sicco pallescentia, breviter petiolata*; panicula *laxa, axillaris, divaricatim ramosa,* floribus *cum pedicellis brevibus articulatis, pubescentiæ pilis punctato-glandulosis.*

1. *Leretia Vellozii.* L. cordata, *Velloz, Flor. Flum.* iii. tab. 2;—ramulis angulatis, cortice rimoso, foliis oblongis, utrinque subacutis, apice breviter attenuatis, coriaceis, nervosis, margine revolutis, petiolo brevi crasso canaliculato; panicula pubescente, floribus extus griseo-pilosulis, intus pilis longissimis ferrugineo-sericeis dense vestitis: drupa majuscula, globosa.—Rio de Janeiro in sylvis maritimis.—*v. v.*

I collected specimens of this plant in 1836 in a wood on the borders of Jurujuba Bay, in the harbour of Rio de Janeiro: it was found also by Gardner on the maritime skirts of the Corcovado range at Tejuco, and by Padre Velloz in the maritime woods at Tagoahy, in the same province: the specimens collected by Moricand in Ilheos, no. 2347, do not appear to me to differ spe-

cifically from the others. It forms a tree with spreading branches, of which the branchlets are acutely angular as above described. Its leaves are 6 inches long, $2\frac{1}{2}$ inches broad, on a petiole $\frac{3}{8}$ of an inch in length: the panicle is from 2 to 3 inches long, with its branches spreading at right angles to the length of $1\frac{1}{2}$ inch: the flower-bud is oval, 2 lines in length; the petals are of a greenish yellow colour, clothed inside with long white silky hairs, which become brown in drying: the ovarium is in like manner sericeous, so that the lower half of the style, and its basal lobes, are concealed. As the name *cordata* may lead to mistake, there being nothing in the form of its leaves or other parts approximating a heart-shape, I have dedicated the species to the author of the genus;—the somewhat truncated base of the kernel of the fruit (probably an accidental occurrence) suggested the above designation*.

Mappia.

This genus, described and figured in the 'Hortus Schœnbrunensis' by Jacquin in 1797, appears to have escaped the notice of all succeeding botanists. The plant upon which it was founded was raised in the Imperial Botanic Garden, but the country from which it was derived was then unknown. There can be no doubt, however, that it is identical with the *Icacina dubia* of McFadyen, and that it is a native of Jamaica. I have also to add many other species from tropical Asia, and Madagascar, so that the range of the genus is considerable. In its floral structure it is very near *Icacina*: it differs from *Apodytes*, *Rhaphiostylis* and *Leretia*, in the absence of any glandular appendage or raised teeth on the summit of the ovarium, and from both, as well as from *Icacina*, in having a shorter, erect, and stronger style, and a lobed hollow stigma, in its calyx being more entire, the anthers more ovate and not so deeply cleft at base, and in its entirely free hypogynous disc, smooth outside and generally very pilose within: in the cristulate apex of the nut, it bears some analogy with that of *Pennantia*. It differs also from *Apodytes*, *Stemonurus* and *Pennantia* in its larger embryo, with large, oval, foliaceous cotyledons, that nearly equal the length of the albumen. It is the *Stemonurus* of Dr. Wight, but differs essentially from the *Stemonurus* of Blume.

The *Nothapodytes* of Blume agrees with this genus in every essential feature. I cannot perceive any difference in the structure of the flowers between the Jamaica and Asiatic species, except in the more glabrous habit of the former, their more lanceolate leaves, and the perfect smoothness of the hypogynous disc,

* This plant, with full generic details, will be shown in plate 7 of the 'Contributions to Botany,' &c.

features that cannot constitute any generic distinction. I have therefore divided them into corresponding tribes.

The following outline of its generic characters has been derived from my own observations.

MAPPIA, Jacq. Stemonurus, *Wight, non Bl.* Nothapodytes, *Bl.* —*Flores* perfecti, interdum polygami. *Calyx* breviter campanulatus, fere integer, denticulis 5 donatus, immutatus et persistens. *Petala* 5, oblonga, carnosula, intus villosa, imo disci inserta, æstivatione valvata, sub anthesi patentia. *Stamina* 5 cum petalis inserta, iisdem alterna; *filamenta* basi dilatata, carnosula, superne subulata, æstivatione induplicata; *antheræ* introrsæ, ovatæ, 2-lobæ, 4-locellatæ, imo breviter bifidæ, *connectivo* tenui, dorso in sinu affixæ, lobis singulatim 2-locellatis, demum septicidis, et longitudinaliter evolutim dehiscentibus. *Pollen* reticulatum, 4-sulcatum vel subquadratum. *Ovarium* liberum, ovatum, interdum subgibbum, villosum, imo glabrum, et disco cupuliformi libero margine lobato, extus glabro, intus sæpissime hirsuto hinc circumdatum, 1-loculare; *ovula* 2, juxta apicem loculi subcollateraliter suspensa, anatropa. *Stylus* teres, interdum brevis, erectus, rarius paullulo curvatus. *Stigma* erectum 2–5-lobum, cavum, demum capitatum. *Drupa* oblonga, epicarpio parco carnosa, olivæformis, ianthina, monopyrena, calyce persistente suffulta: *putamen* osseum, tenue, extus irregulariter sulcato-rugosum, crista apicali et laterali; *semen* suspensum, oblongum, *testa* membranacea, raphe dorsali, ab apice versus basin tendens, *chalaza* fere basali: *embryo* in axi *albuminis* carnosi immersus, orthotropus, inversus, fere ejusdem longitudine, *cotyledonibus* majusculis, foliaceis, ovatis, *radicula* 3-plo longioribus.—Arbores *in Asia tropica, et Antillis crescentes,* folia *lanceolata, oblonga, aut ovata, acuminata, integra, subpubescentia, petiolata*; inflorescentia *paniculata, terminalis,* flores *parvuli, flavescentes, odore fœtido, rarius suaveolente emittentes, cum pedicellis articulati.*

§ 1. EUMAPPIA. Discus cupularis profunde et obtuse 5-lobatus, lobis extus 2-costatis, utrinque glaberrimis. *Species Antillanæ.*

1. *Mappia racemosa,* Jacq. Hort. Schœnb. i. 22. tab. 47. Icacina dubia, *McFad, Fl. Jam.* i. 122;—foliis lanceolatis, utrinque acutis, glaberrimis, nitidis, penninerviis, nervorum axillis glandula supra verrucæformi subtus cava signatis, petiolo longiusculo, glabro, canaliculato; paniculis axillaribus, folio brevioribus, plurifloris, floribus parvis, flavescentibus, odore fœtido, calyce glabro, denticulato, petalis extus lævibus, intus sericeis.—Jamaica; *v. s. in herb. Hooker* (*MacFadyen*).

The figure of Jacquin gives a very faithful representation of this plant, as well as good details of the structure of the flower. The fleshy immersed gland, about the size of a millet seed, seen near the axil of each nerve, offers a very characteristic mark of this species; its leaves are 4 inches long, $1\frac{1}{4}$ inch broad, upon a petiole of 6 or 8 lines: the panicle is $2\frac{1}{2}$ inches long. The whole plant, as in some other species of this genus, becomes black in drying.

2. *Mappia affinis*, n. sp.;—ramulis lenticellis elongatis, verrucosis, albidis maculatis; foliis lanceolatis, basi minus acutis, glaberrimis, nitidis, penninerviis, nervis eglandulosis, petiolo breviori, canaliculato; paniculis glabris, axillaribus, folio multo brevioribus, multifloris, floribus parvulis, odore suaveolente, calyce subpubescente, petalis extus glabris, intus sericeo-pilosis. —Manchester, Ins. Jamaicæ; *v. s. in herb. Hook.* (*Purdie*).

This species is very similar to the foregoing one, but is distinguished by the want of the peculiar nerval gland and by the whole plant becoming less black in drying. Its leaves are $5\frac{1}{2}$ inches long, $1\frac{1}{2}$ inch broad, on a petiole half an inch in length: the panicle is $1\frac{1}{2}$ to 2 inches long.

§ 2. Trichocrater. Discus cupularis, 5-dentatus, extus glaber et 10-costatus, intus pilis longis indutus. *Species Asiaticæ.*

3. *Mappia fœtida.* Stemonurus fœtidus, *Wight, Icon.* tab. 955; *Spic. Neilgh.* tab. 23;—foliis ovato-ellipticis vel elliptico-oblongis, apice repente attenuatis, valde reticulato-venosis, utrinque parce pubescentibus, subtus glauco-pallidis nervis venisque prominentibus; paniculis terminalibus cymosis breviter pilosis; floribus subparvis, flavis, fœtidis, sæpe omnibus masculis; calyce acute 5-dentato; drupa olivæformi, purpurea, putamine tenui.—Neilgherries; *v. s. in herb. Hook.* (*Wight*).

This is described as a large umbraceous tree, and I observe the specimens do not become black in drying; the leaves are generally 4 or 5, sometimes even 7 inches long, usually 2, rarely 3 inches broad on a petiole $\frac{3}{4}$ inch in length: the panicle is from 2 to 3 inches long, much spreading, with numerous flowers; the buds are ovate, nearly 2 lines long, and the flowers, which exhale a rank smell of carrion, are larger than most of the species of this genus; the calyx is deeply and acutely dentate; the petals are very pilose outside, covered with sericeous hairs inside, and marked by a raised longitudinal nervure; the anthers are oblong, with a mucronulate apex; the ovarium and erect style are densely covered with long pilose hairs, but the former is glabrous at its

base, where it is surrounded by a short free cup, which is quite smooth outside and densely sericeous within.

4. *Mappia oblonga*, n. sp.;—foliis oblongis, utrinque acutis, summo longiuscule attenuatis, supra glabris, nervosis, nerviis 7–9-jugis, venisque subtus sparse pubescentibus, petiolo elongato, gracili, glabro, canaliculato; panicula laxa, terminali, pubescente, folio dimidio breviori, divaricate ramosa, ramulis elongatis, floribus majusculis valde pilosis, calyce submembranaceo denticulato.—Bombay—Ghauts; *v. s. in herb. Hook.* (*Dalzell*).

The leaves of this species are 6 inches long, 3 inches broad, on a petiole $1\frac{1}{4}$ inch in length; the terminal panicle measures 3 inches.

A specimen in the Wallichian herbarium, no. 9064, under the name of "*Cordia*," is probably only a variety of this species: it is from Travancore, collected by Dr. Wight, and may be thus designated:—

Var. *elliptica*, ramulis angulatis, foliis minoribus, ellipticis, basi obtusioribus, apice breviter attenuatis.

5. *Mappia ovata*, n. sp.;—ramulis glabris angulatis; foliis ovato-oblongis, basi inæquilateribus, apice subito attenuatis, fere glabris, supra nitidis, læte virentibus, creberrime reticulatis, venosis, subtus glaucis et resinoso-punctatis, margine subrevolutis, nervis venisque utrinque sparse pubescentibus, subtus in axillas venarum barbatis, petiolo gracili, valde elongato, glabro; panicula subterminali, floribus parvis, pubescentibus; calyce 5-dentato.—Ceylon—Hautane, altit. 2300 ped.; *v. s. in herb. meo et Hook.* (*Gardn.* 99).

This is a very distinct species; the branchlets appear fistulose and angular; the leaves are broader than other species, being $6\frac{1}{2}$ inches long, and 4 inches broad, on a petiole of 2 or $2\frac{1}{4}$ inches; the panicle, on a lengthened peduncle, does not exceed 2 inches in length; the flowers are small, and densely tomentose*.

6. *Mappia Gardneriana*, n. sp.;—foliis oblongis, basi obtusis et inæquilateribus, apice subito attenuatis, margine subrevolutis, supra fere glabris, subtus ferrugineo-glaucescentibus, et parce pubescentibus, punctis creberrimis minutis notatis, nervis 8-jugis supra impressis, subtus prominentibus, fuscis, pilosulis, petiolo elongato, canaliculato; panicula subterminali, pilosa, pedunculo crassiusculo, petalis intus pilis dense vestitis, calyce denticulato.—Ceylon—Newer Ellia, altit. 6000 ped.; *v. s. in herb. meo et Hook.* (*Gardn.* 98), Galagama (*Thwaites*, no. 492).

* A figure of this species, with ample generic details, will be seen in plate 8 of the 'Contributions to Botany,' &c.

This species greatly resembles *M. fœtida*; the nervures of the leaves are sometimes a little barbate at base. The leaves are $5\frac{1}{2}$ inches long, $2\frac{3}{4}$ inches broad, on a petiole of 1 or $1\frac{1}{4}$ inch in length. It is one of the commonest plants of Ceylon, and called by the natives *Ganda pang*, meaning "stinking lamp," on account of the extremely fœtid odour of its flowers.

7. *Mappia Championiana*, n. sp.;—cortice suberoso, foliis oblongis, apice attenuatis, costæ summo imoque recurvis hinc subconduplicatis, textura tenuibus, utrinque sparse pubescentibus, subtus pallide flavidis, nervis paucijugis prominentibus et rufulis, reticulato-venosis, venulis in areolis liberis et furcatis: panicula cymoso-terminali, longe stipitata, 2–3-chotome ramosa, ramis elongatis gracilibus, floribus crebris dense pilosis, odore fœtidis; drupa ovali, putamine rugoso.—Ceylon; *v. s. in herb. Champ. et Hook.* (Col. Walker, Major Champion).

The leaves in this species are $4\frac{1}{2}$ to 7 inches long, $2\frac{1}{4}$ to 3 inches broad, on a petiole $\frac{3}{4}$ to 1 inch in length. It is certainly different both from the *M. Gardneriana* and *M. fœtida*, having leaves of much thinner texture, beautifully reticulated, and with fewer nervures, these scarcely exceeding 5 pairs: its flower stem and branchlets are much more slender: on account of the fœtid odour of its flowers, it also bears the vernacular name of *Ganda pang*.

8. *Mappia Wightiana*, n. sp.;—foliis lanceolato-oblongis apice subito attenuatis, a medio ad basin gradatim angustioribus textura tenuibus, utrinque glabris, subtus glaucescenti-pallidis, nervis rufulis, eleganter reticulatis, venulis in areolis liberis et furcatis, margine revolutis, petiolo gracili canaliculato, costaque sparse pubescentibus: panicula terminali dichotome ramosa, sparse pubescente, floribus adpresse pilosis, calyce brevissimo, denticulato, hirsuto, disco intus longissime hirto.—Madras; *v. s. in herb. Hook.* (Wight, 'Beureria?' no. 647).

This is certainly a very distinct species, and bears much analogy with the preceding: it is distinguishable by the shape and greater length of its more flattened leaves, which are almost membranaceous in texture, their reticulations being regularly anastomosed like the fronds of some ferns; the leaves are 7 to 8 inches long, 3 inches broad, on a petiole $1\frac{3}{8}$ in length; the raceme is 3 inches long; the flowers are remarkable for the greater rigidity of the pubescence, for the small size of their hirsute calyx, and for the length of the rigid hairs that spring from the internal face of the cupular disk, which form a close erect crown, concealing more than half the ovarium.

9. *Mappia tomentosa*, n. sp.;—foliis oblongis, basi obtusis, apice acuminatis, vix attenuatis, coriaceis, supra glabriusculis, nervis

8-jugis, subtus demissu fulvo-tomentosis, rachi versus basin valde prominenti, petiolo crasso, canaliculato, tomentoso; panicula terminali, tomentosa, multiflora, ramo ramulisque crassis, pedicellis confertis, cum floribus articulatis; drupa sanguinea pilosa, majuscula, pulposa, putamine rugoso, nigro. —Neilgherries; *v. s. in herb. Champion.*

This is also a very distinct species: the leaves are much channelled at both extremities, and the midrib is very prominent towards the base, so that the continuous thick petiole stands at a considerable angle with the plane of the blade; they are smooth above, and below are thickly covered with dense yellowish tomentum; they are 6 inches long, and $2\frac{3}{4}$ broad, on a petiole 1 inch in length; the panicle is 4 inches long, its stem being 2 lines thick. The specimen in Capt. Champion's herbarium is very short, so that the lower leaves are probably much larger: the berry is nearly an inch in length and $\frac{3}{4}$ inch in diameter.

10. *Mappia montana.* Nothapodytes montana, *Bl. Mus. Bot. Lugd. Bat.* 248;—arbor ramosissima, ramis dichotomo-ramulosis, foliis sparsis, oblongis vel lanceolatis, utrinque angustatis, integerrimis, subcoriaceis, glabris, supra lucidis, subtus reticulato-venosis, petiolatis; paniculis corymbosis axillaribus vel infra gemmam terminalem ortis, cum alabastris pube sericea obductis; floribus parvis, brevissime pedicellatis, subcalyce articulatis, ebracteatis.—Java.

As the features offered by Prof. Blume in the work above cited, of his genus *Nothapodytes*, quite correspond with those of *Mappia*, I feel no hesitation in considering these genera as identical; the characters of this species there given, being also analogous to the plants above described, and the proximity of the countries of their origin, all seem to confirm this conclusion.

Desmostachys.

I propose to establish this genus upon a plant of very peculiar habit from Madagascar, which I have found in the herbaria of Dr. Lindley and Sir William Hooker, remarkable for its several slender spicated racemes, growing out of each axil, whence its generic name, and which I adopt upon a manuscript suggestion of Dr. Planchon. It resembles *Mappia* in the structure of its flowers, but the floral parts are far more delicate and membranaceous in texture, and retain their yellowish colour in drying; the stamens and style are marked with numerous pellucid dots, and the anther-cells are thin and membranaceous; the ovarium is covered with very long setose hairs and is seated on a distinctly 5-lobed disk.

Desmostachys, gen. nov.—*Flores* perfecti. *Calyx* minimus, brevissime cupulatus, 5-dentatus, ciliatus, persistens. *Petala* 5, æqualia, hypogyna, lineari-oblonga, membranacea, extus pilosa, æstivatione valvata, apice inflexa, sub anthesi patentia. *Stamina* 5, longitudine petalorum et iis alterna; *filamenta* tenuiter linearia, membranacea, apice attenuata, disco inter lobos alternatim extus inserta; *antheræ* oblongæ, 2-lobæ, 4-locellatæ, imo breviter 2-fidæ, dorso medio affixæ, lobis membranaceis, singulatim 2-locellatis, demum septicidis et longitudinaliter evolutim dehiscentibus. *Ovarium* liberum, ovatum, villosum, *disco* cupuliformi obtuse 5-lobato suffultum, 1-loculare; *ovula* 2, juxta apicem loculi superposita, podospermio crasso subcollateraliter suspensa, anatropa. *Stylus* erectus, gracilis, glaber, pellucido-punctatus. *Stigma* obsolete lobatum. *Fructus* ignotus.—Frutex *scandens Madagascariensis*; folia *alterna, ovata, coriacea, glaberrima, petiolata*; racemi *plurimi, axillares, spicati, gracillimi, pauciflori, folio subbreviores,* floribus *minimis, sessilibus, bracteatis.*

1. *Desmostachys Planchonianus,* n. sp.;—scandens, ramulis teretibus, lævibus; foliis cuneato-ovatis vel lanceolato-oblongis, apice brevissime et repente attenuatis, crasso-coriaceis, utrinque lucidis et glaberrimis, supra læte viridibus, subtus pallidis, nervis venisque valde reticulatis prominentibus, margine revolutis, petiolo brevi, brunneo, rugoso, inflexo, canaliculato; racemis in axillis 5–8-fasciculatis, spicatis, gracillimis, pubescentibus, folio brevioribus, floribus minutis, alternatim sessilibus, petalis virescenti-flavidis.—Madagascar; *v. s. in herb. Lindley* (*Forbes*), *in herb. Hook.* (*Lyall*).

Among the several specimens I have seen of this plant, some have their leaves quite ovate, others nearly lanceolate, but as their shape varies in the same plant, they must all be considered as one species. It is described as climbing upon other trees, in the Province of Be-Zemcharak: the leaves are thin and coriaceous, shining, very reticulated, of a very light green colour above, from $2\frac{1}{2}$ to 4 inches long, and from $1\frac{1}{8}$ to $1\frac{1}{2}$ inch broad, upon a thin incurved petiole, with a dark brown corrugated surface: from 4 to 8 slender spikes grow out of each of the upper axils, measuring 1 inch to $1\frac{1}{2}$ inch in length; the flowers are alternately arranged, are quite sessile upon the slender pubescent peduncle, and are 1 line long, with a minute pubescent bract at the base of each*.

* A drawing of this species with figures of its floral analysis, will be given in plate 9 of the 'Contributions to Botany,' &c.

XXXII.—*On the* Venus undata *of authors*. By William Clark, Esq.

To the Editors of the Annals of Natural History.

Gentlemen, Norfolk Crescent, Bath, March 20, 1852.

The *Venus undata* of the older conchological authorities, which has been justly separated from *Venus* by more recent writers under various appellations, and particularly by the learned authors of the 'British Mollusca' under the title of *Lucinopsis undata*, has given rise to much difference of opinion amongst malacologists in regard to its natural position. Though the shell of this species, anomalous in several points, has long been known, the aggregation of the curious characters of its animal has never been sufficiently described, from the difficulty of procuring it alive of large size. The quotation from my manuscript in the 'British Mollusca' is the result of the examination of very small specimens, not more than $\frac{3}{8}$ths of an inch diameter, though it is as correct and full as could well be expected from such materials; but the receipt from Exmouth of adult lively examples of $1\frac{1}{2}$ inch diameter, has enabled me to review and add to it several unrecorded features, which I think will interest some of your readers, and show that this peculiar genus has scarcely yet received its precise natural allocation; and many important circumstances will be developed, which may assist to determine the proper station of some other bivalve molluscan groups, by the concatenation of characters exhibited by this animal, illustrative of its connection with them.

Lucinopsis undata, Brit. Moll.

Venus undata, auctorum.

Animal inhabiting a shell of thin and fragile texture, like many of the *Tellinæ*, irregularly subrotund, and not exhibiting the decided lenticular form of its shell; the general colour is pale pinkish drab, which, when the animal has been killed by hot water, often changes to the various hues of orange, red and brown: this remark is of some importance as regards correct description, for under similar circumstances this condition prevails more or less in all the testaceous Mollusca, and particularly in the bivalves. The mantle has its edges sinuated or furbelowed, in some examples irregularly jagged, but not serrated; the ventral aperture is very contracted, only affording space for the issue of a moderately sized foot, in consequence of the basal position and very large size of the posterior adductor; and though the anterior one is nearer the dorsal region, it also, from the length, contributes to the smallness of the pedal aperture; the

mantle is produced posteriorly into two very long pale orange siphons divergent and separated to their bases; the branchial one is the smallest and longest, being in adult examples in full extension $1\frac{1}{2}$ inch long, and having the extremity margined by a circle of very short, minute dark lines, blotches or dots, with 16–20 white cirrhi of irregular sizes and lengths; the anal siphon is of rather larger diameter, and when protruded is barely an inch in length; its extremity is furnished with 12–15 white, short cirrhi, of more uniform length than in the branchial; it has not the dark terminal margin of points: the usual hyaline valve was not observed, but it probably exists.

This siphonal apparatus has the entire aspect of that of the typical *Tellinidæ*; but its position when exserted is singular, being very little posterior to the centre of the ventral range, instead of being, as is more usual, protruded from a posterior angle somewhat more basal, than a right one to a vertical line drawn from the beaks to the ventral centre; this nearly central basal site is occasioned by the great size and low position of the posterior adductor, which necessarily compels the issue I have described.

The foot is white, not large, flat, bevelled, pointed, very little geniculated, without a byssal groove, scarcely differing from the *Tellinæ* and some of the *Veneres*; it also, from the causes assigned to the siphons, has a more basal position than usual when protruded, with a very limited anterior action, from which it may be inferred that the motive power is confined to the turning from side to side and on its centre. The branchiæ are subcircular, the upper plates being much less than the lower, half lapping on them, pale drab, with moderately fine but not very distinct pectinations; the pair of palpi on each side are fleshy, rather long, triangular, pointed, strongly pectinated on the outsides, smooth within, and connected with each other around the mouth; they are also light drab. The body is pale pink, small and subglobular, having the foot fixed to its centre. The liver is grass-green. I have already alluded to the texture of the shell, but it is necessary to add, that in the right valve there are two laminar primary teeth, and in the left two similar ones, with a strong double tooth between them: there are no laterals.

It would then appear, that the texture of the shell, the two laminar teeth in the right valve, and the exact similitude to the typical *Tellinæ,* of the very long, slender, divergent siphonal apparatus having each tube completely separated to the base, ally this animal by many degrees nearer to the *Tellinidæ* than to the *Veneridæ,* as none of the genera of the latter family have any resemblance to this siphonal condition; still it cannot be lost sight of, that the three primary teeth in the left valve, which ap-

pear in no tribe but in that of the *Veneres*, give it a decided connecting link with them.

As to the alliance of *Lucinopsis* with *Lucina* it is not very near, and principally consists in its lenticular shape, which, however, is that of many of the *Veneres*, so that a less significant appellation might have been preferable. I must likewise observe, that there are some differences of shape and position from either the *Tellinæ* or *Veneres* in the adductor cicatrices of *Lucinopsis*, which have a slight approach to the *Lucinæ*; in other respects there is little in common between the two, there being no siphonal apparatus, and a very peculiar foot in *Lucina*.

These remarks may induce malacologists to take into consideration that, the *Tellinidæ* and *Veneridæ* being so closely allied by the intervention of *Lucinopsis*, it would be desirable to remove the *Mactræ* into the vicinity of *Cyprina*, to follow it and precede *Cardium*, in which case the line would march thus:—*Tellinidæ*, including the *Donaces*, *Lucinopsis*; the *Veneridæ*, embracing *Cyprina* and its adjuncts; then *Mactra*, *Cardium*, &c., which two latter genera as regards both the animal and shell have some points of agreement, and by relieving the *Tellinidæ* and *Veneridæ* of the intermediacy of the *Mactræ*, perhaps a greater approach to a natural position would be obtained.

The peculiar characters of the shell of *Mactra* create a difficulty with respect to natural order, as it has many features of the *Myadæ* and *Anatinæ*; but the open mantle of the animal will not allow it to be so near a neighbour to them as to precede the *Tellinidæ*; neither can it remain between the latter family and the *Veneres*, the union of which I think is more naturally effected by *Lucinopsis*, notwithstanding the anomalies that exist in that genus. The siphons of *Mactra* are altogether different from those of the *Tellinæ*; their tubes are more congruous with the *Veneridæ*, so that it might have been placed immediately after the typical *Veneres* if the *Cyprinidæ* had not intervened, which, however, cannot be severed from them, merely because their siphons are so short as scarcely to produce a scar;—therefore it would appear difficult to fix *Mactra* otherwise than to follow the *Cyprinidæ*, and come into line with the *Cardia*.

I am, Gentlemen, your most obedient servant,

WILLIAM CLARK.

Erratum in the paper on *Lepton Clarkiæ*, 'Annals,' N. S. vol. ix. p. 293:—

For "I was all but convinced that the *Lepton convexum* and *L. nitidum* were *identical*," *read* "I was all but convinced that the *Lepton convexum* and *L. nitidum* were *distinct*."

XXXIII.—*Notes on some Scotch Zoophytes and Polyzoa.* By Wyville T. C. Thomson, Sec. R.P.S., F.B.S.E., Lecturer on Botany, King's College, Aberdeen.

[With a Plate.]

Sir, Bonsyde near Linlithgow, Jan. 12, 1852.

In going over some of the Scotch Zoophytes and Polyzoa, I have met with several species, partially described by Sir John Graham Dalyell, in his 'Rare and Remarkable Animals of Scotland.' Some of these species appear to be new, and others it is not very easy, without a little consideration, to identify. Of one of the former I send you a sketch and description; of two others, *Sertularia fascis* and *Triticella flava*, I hope to have something to say shortly, but a few observations are still wanting.

To Richard Taylor, Esq.

Polyzoa infundibulata.

Vesicularina. Fam. Vesiculariadæ.

Avenella, Dalyell.

Diag. Polypidom confervoid, filiform, very much attenuated, creeping, nearly simple. Cells large, solitary, irregularly scattered, sub-unilateral, slightly contracted towards the apex, curved.

Animal an ascidian mollusk with from twenty to twenty-four ciliated tentacula; gizzard small.

A. Dalyellii, Wy. T. Cells slightly rough with scattered, patent, horny bristles. Plate XVI. B.

Sir John Dalyell, in the 2nd vol. of his 'Remarkable Animals,' bestowed upon this mollusk *provisionally* the name of *Avenella fusca*. "*Fusca*" is not a very appropriate specific name, as all the species belonging to the genus, yet to be discovered, will probably have an equal claim to the title. As Sir John has as yet no namesake among a race whose manners and customs he so carefully studied, I have taken the liberty of proposing in preference the specific name "*Dalyellii*," a tribute due to his labours in an obscure and unfrequented path.

One of the largest and most conspicuous of our Vesicularian Polyzoa, I have found *Avenella Dalyellii* very abundantly at some seasons among the rejectamenta of the oyster dredges at Newhaven, covering with dense tangled masses *Thoa muricata, halecina, Beanii*, and other corallines from rather deep water. I met with it once on *Sertularia margareta*, off Port Appin, Argyllshire, and twice among rejectamenta from the Dogger Bank.

The mollusk is, like all the rest of its family, very persistent.

I have dried many specimens on mica with the tentacula expanded. It appears to be, like others of its class, a delicate animal, and does not survive long in captivity.

A sertularian zoophyte noticed by Dalyell under the name of *Sertularia Arcta*, and described by Dr. Hassall as *Coppinia mirabilis*, is frequent in the Firth of Forth, much more so in deep water off Aberdeen, and has been met with by my friend Mr. Peach off Peterhead. It seems to be absent from the west coast of Scotland. Great confusion exists with regard to the synonymy of this species. It is confounded with *Campanularia intertexta* of Couch, a true *Campanularia*.

I am, Sir, your obedient servant,
Wyville T. C. Thomson.

P.S. To aid in clearing up some doubts with regard to the distribution of the Urchin, *Arachnoides placenta*, I think it right to notice a specimen received from the Burmese coast.—W. T. C. T.

XXXIV.—*Characters of new species of* Helix *from Southern India and Bengal.* By W. H. Benson, Esq.

Before proceeding to the descriptions of the following species, I may remark that, with the exception of *Succinea Imperialis*, nobis (proving to be a variety of Dr. Pfeiffer's *S. picta*, with which I was unacquainted in consequence of the delayed publication of the 'Zoological Proceedings' of 1849), and of *Helix Orobia, solata, Ampulla, cacuminifera, crinigera*, and *acuducta*, nobis, the whole of the *Helicidæ* described in my papers contained in former numbers of this Journal have been figured by Dr. Pfeiffer for the Martini-Chemnitz Conchylien Cabinet. The name of *H. munda*, nobis, has been altered by that author to *H. cerea*, Pfr., the former designation having been applied in 1849, by the American conchologist, Adams, to a Jamaican shell. The *Helices* which I had omitted to take with me to Germany will be figured in Lovell Reeve's 'Conchologia Iconica.' *H. regalis*, nobis, from Borneo, was subsequently given in the 'Zoology of the Samarang,' as *H. vittata*, A. & B., a name which had been long applied to a Ceylonese species. The brown variety has now been portrayed under the correct name of *H. regalis* (no. 426, plate 80 of *Helix*) in the 'Conchologia Iconica;' but in neither instance have the obsolete nodulose costæ on the intermediate whorls of the spire been represented.

1. *Helix Cysis*, nobis, n. sp.

Testa anguste et profunde umbilicata, sinistrorsa, depresso-globosa,

tenuiuscula, oblique plicato-striata, fuscescente-cornea, spira convexa, apice planato; anfractibus 4, convexis, celeriter accrescentibus, ultimo inflato, primo obsolete angulato, tunc rotundato, antice breviter descendente, subtus tumido; apertura obliqua magna, subovato-lunata, peristomate simplici, acuto, marginibus conniventibus, externo et basali vix incrassatis, columellari breviter reflexiusculo.

Diam. major 43, minor 35, alt. 23 mill.

Hab. in Montibus "Nilgherries" Indiæ Australis. Teste Jerdon.

In form it is more globose and inflated than the other sinistral *Helices*, excepting *H. cicatricosa*, Müll., *quæsita*, Desh., and *Bajadera*, Pfr. In figure it more nearly approaches *H. quæsita*, Desh. (Fér. t. 10. B. fig. 10, 12), but differs in the narrow umbilicus, smaller number of whorls, with a greater size, as well as in colour, texture, and less developed peristome.

2. *Helix Thyreus*, nobis, n. s.

Testa profunde umbilicata, sinistrorsa depressa, orbiculata, supra cerea cornea, oblique radiatim plicato-striata, striis spiralibus exilissimis decussata, subtus convexa, polita, radiato-striata, fuscescente-cornea, infra carinam breviter saturatiore; spira convexiuscula, apice planato; anfractibus $4\frac{1}{2}$, convexiusculis, lente accrescentibus, ultimo obtuse carinato, non descendente; apertura obliqua, lunata, intus livide purpurea, margine expansiusculo, reflexiusculo, columellari breviter recte descendente cum basali angulum efformante.

Diam. major 34, minor 29, alt. 16 mill.

Hab. in India Australi. Teste Jerdon.

The umbilicus, although moderate, is peculiarly deep and distinct, comparatively with other orbiculate depressed shells of the group, showing, like *H. quæsita*, all the whorls internally to the apex.

3. *Helix bidenticulata*, nobis, n. s.

Testa perforata, depresso-conica, obsolete radiato-striata, albida (decorticata) spira subconica, apice obtuso, sutura impressa; anfractibus 6, arcte convolutis, convexis, omnibus superne lineis duabus æquidistantibus elevatiusculis instructis, ultimo carinato, subtus convexo; apertura arcte securiformi, verticali, peristomatis margine superiori brevissimo, columellari oblique descendente, expanso, superne reflexo, basali arcuato, dentibus duobus minutis distantibus, submarginalibus, dextro prominentiore, munito; perforatione pervia.

Diam. major 3, minor $2\frac{2}{3}$, axis $2\frac{1}{3}$ mill.

Hab. in montium "Nilgherries" vallibus calidioribus. Teste Jerdon.

This interesting little species, remarkable on account of its narrow aperture and spiral ridges on the spire, is the only known

cis-Gangetic species provided with teeth in the mouth. These are apt to be overlooked, or mistaken for accidental grains of white sand.

The next form was described and published twelve years ago; but as fuller characters are desirable for the purpose of comparison with the two subsequent species, I insert them here.

4. *Helix vesicula*, nobis (amended character).

Testa perforata, depressiuscula, vel subdepresso-globosa, obsolete striata polita, pellucida, pallide cornea; spira plus minusve elevata, apice acutiusculo; sutura submarginata; anfractibus $5\frac{1}{2}$-6, convexiusculis, sensim crescentibus, ultimo rotundato, ventricosiusculo; apertura vix obliqua, rotundato-lunari, longitudine latitudinem æquante; peristomate simplici, recto, margine columellari verticali, breviter reflexo, cum basali angulum rotundatum efformante, perforatione membrano fere clausa.

Diam. major $14\frac{1}{2}$, minor 12, axis $7\frac{1}{2}$ mill.

Var. Diam. major 14, axis $8\frac{1}{2}$ mill.

N. vesicula, Benson, Jour. Asiat. Soc. Calcutta, vol. vii. p. 216, 1838.

Hab. in agris Bengalensibus prope Soti-Durga, ad apicem Deltæ Gangeticæ.

I discovered this pretty species during the rainy season of 1835, in a river voyage from Calcutta to Benares, on the branches of a shrubby *Zizyphus*, and below Rajmahal on *Asclepias gigantea*, not creeping on the ground like its darker-coloured ally *H. vitrinoides*, Desh. The animal was, as in that species, a *Macrochlamys*, nobis, 'Jour. Asiat. Soc.' vol. i., 1832 (as distinguished from that of *Ariophanta*, Desmoulins, 1829, which corresponds with that of *Nanina*, Gray, 1834), with reference to the great length and narrowness of the tentacula-like processes of the mantle, which lubricate the surface of the shell even to the apex. A full description of the animal of *H. vitrinoides* will be found in vol. v. of the 'Zoological Journal' for 1834, long prior to the date of Mr. Strickland's observations on the same subject in the 'Annals' for November, 1849.

5. *Helix Lecythis*, nobis, n. s.

Testa subobtecte perforata, depressiuscula vel orbiculato-conoidea, obsolete striata, nitida, pellucida, pallide cornea; spira plus minusve elevata, apice acutiusculo, sutura submarginata; anfractibus 6, convexiusculis, sensim crescentibus, ultimo rotundato: apertura vix obliqua, lunari, latitudine longitudinem vix superante, callo parietali tenui rugosiusculo; peristomate simplici, recto, margine columellari oblique arcuatim descendente, superne triangulato reflexo; perforatione membrano fere clausa.

Diam. major 14, minor 13, alt. 9 mill.

Var. Diam. major 12, minor 10, alt. 6 mill.

Hab. in montibus prope Rajmahal Bengaliæ. Teste Dr. J. F. Bacon.

Distinguished chiefly from *H. vesicula* by the less ventricose form of the last whorl, the shorter reflexion at the top of the pillar lip, and by the aperture, which is broader than long in this species, and has not the vertical position of the columellar lip, so conspicuous in that shell. It varies much also in the relative height of the spire.

6. *Helix subjecta,* nobis, n. s.

Testa obtecte perforata, orbiculato-conoidea, striata, nitidiuscula, cornea, translucente; spira acutiuscula, sutura submarginata; anfractibus 6, ultimo latiori, rotundato; apertura vix obliqua, late lunari; peristomate simplici, recto, margine columellari oblique descendente, superne late triangulari-reflexo, perforationem obtegente.
Diam. major 17, minor 14, axis $8\frac{1}{2}$ mill.
Hab. in montibus Bengaliæ, non procul ab urbe Rajmahal. Teste Dr. Bacon.

Distinguished from the two last-described shells by the colour, proportion of the last whorl, and characters of the aperture. It was sent to Dr. Pfeiffer to be figured under the MSS. name of "*spreta,*" which has been now altered with reference to the prior use of that name by Adams.

London, April 10, 1852.

XXXV.—*Observations on* Hyperoodon latifrons. By J. E. Gray, Ph.D., F.R.S., V.P.Z.S. &c.

In Professor Eschricht's paper on the Gangetic Dolphin, so well translated by Dr. Wallich, he observes, first referring to a previous paper of his own, "Mr. Gray's *Hyperoodon latifrons* is a good species founded on a cranium from the Orkney Islands, with the crest of the upper jaw unusally thick, and yet it may perhaps be only the cranium of an old male of the common Hyperoodon." He then proceeds: "This supposition has since become a matter of certainty, for *all* the crania of old Hyperoodons, at least of males, have the crest similarly developed, as has actually been verified in a skeleton of an old individual of this kind sent to my worthy colleague Professor Steenstrup from the Faröe Islands."

It appears from the above paragraph, that the only reason which Professor Eschricht has for pronouncing "all the crania of old Hyperoodons, at least of males, to have the crests similarly developed," is that a single specimen of the animal, which has been found in Faröe Islands, was a male. Now I was assured by the fishermen who procured the head which I de-

scribed and figured, that it was that of a female gravid with young. A female specimen of the same species, as proved by the examination of its skull (described in my Catalogue of Cetacea, p. 70) in the Museum of the University of Edinburgh, was captured in the Firth of Forth, accompanied by a young male (see W. Thompson, Ann. and Mag. Nat. Hist. 1846, vol. xvii. p. 153). Other specimens of this whale have been caught on the coast of England, especially one in Lancaster Bay, but I am not aware that the sex of that individual was recorded.

I have observed the skull of at least one specimen which was marked as being that of a male animal, which certainly belonged to the common species; and my late lamented friend Mr. William Thompson described a male specimen which was caught at Belfast, the skeleton of which is preserved in the Belfast Museum, which that naturalist refers to the common species.

It is also to be observed, that in the above paragraph the Professor appears to think that the only difference between the two skulls is the thickness of the crest, but in the descriptive Catalogue of the Cetacea in the British Museum, I observe: "The examination of four skeletons and six or eight skulls of *H. rostratum*, and of three (four) skulls of this species (*H. latifrons*) have satisfied me that it must remain a perfectly distinct species: it not only differs from *H. rostratum* in the thickness and solidity of the crest, but in the crest being much higher than the hinder part of the head, while in all the skulls of *H. rostratum* the crest is of the same height as the frontal ridge."—p. 70.

The skull of *Hyperoodon latifrons* is one-third longer than that of *H. rostratum*, the latter being usually 60 and the other 90 or 92 inches long. Under these circumstances I must consider that Professor Eschricht's supposition has not "become a matter of certainty," for the evidence is certainly very adverse to the theory.

The Professor in the same manner considers the *Physeter bidens* of Sowerby and the *Dauphin du Havre* of Blainville (the *Delphinus micropterus* of Cuvier) to be the same species. It is true, the only specimen of the former which has been recorded was a male, and that the two specimens of the latter which have been described were females; but this is scarcely sufficient evidence. Before Professor Eschricht made this suggestion, which he evidently considers very important, in the 'Annals and Magazine of Natural History' for 1846, I had regarded the three animals as belonging to the same species, "believing the difference in the size of the teeth, which Mr. James Sowerby's description appears to indicate, to be only a peculiarity produced by the age of the specimen;" but when I had the opportunity of examining the skull, I considered myself justified in regarding them as distinct

species belonging to different genera as then established (see Cat. Cetacea, p. 72), but I think M. Duvernoy has perhaps been correct in now referring them to the same genus, as M. F. Cuvier's figures and description of the skull of *D. micropterus* is very inaccurate and imperfect (see Ann. Sci. Nat. 1851, t. 2. f. 3, 3).

These observations are more important, as up to this time we have no proof of there being any considerable difference between the skulls of the two sexes of whales or dolphins, and my experience is against the theory; for after measuring and comparing all the skulls of these animals which I could find in the various European Museums, several hundreds in number, I have been struck with the great uniformity in size, proportion, and form of the skull of the different species.

It is to be regretted that so excellent a paper as the description of the animal and skeleton of *Delphinus gangeticus* should be deformed by so many captious observations on the labours of others, especially as many of them are not deserved or founded on justice. Many of the observations which M. Eschricht has indulged in respecting my labours on this class of animals have been corrected by myself in the Descriptive Catalogue of Cetacea in the Collection of the British Museum, which was published in 1850, one year before the Professor's paper, and which he quotes in the second page of his Essay. I will only refer to a few of these observations.

Thus: 1. Dr. Eschricht, in a note having very little to do with the Essay, observes, that he believes the drawing of Duhamel's (*D. canadensis*) which I obtained from M. De Blainville, and which I at first thought might probably be (not be) an *Inia*, is only a *Beluga*. In 1850 I had, in the Catalogue (p. 78) above referred to, already observed: "From inquiries recently made in Canada, I have very little doubt but that Duhamel's animal was a *Beluga*, which is common in that country." I may further remark, that if it had not been for the opportunity of inspecting the original drawing of Duhamel, which I obtained from M. De Blainville, showing the absence of the dorsal fin, neither Professor Eschricht nor I could have divined that the dolphin with the beaked nose represented the beakless *Beluga*, for the absence of the fin is not mentioned in the description.

Secondly. The Professor states, that "the cranium of Sowerby's valuable specimen deposited in the Anatomical Museum of the University of Oxford was reported by Mr. Gray as no longer existing there, &c. It was therefore a very gratifying surprise to me to be favoured with a communication from Prof. Acland, Curator to the Museum, to the effect that the specimen was quite safe in his custody."

Any one reading the above would suspect that I had made a careless misstatement. The following is the only observation I had made on the subject: "The skull was preserved in Mr. Sowerby's Museum in Mead Place, and when distributed at his death Mr. James Sowerby informed me it was purchased by the Rev. Dr. Buckland, the Dean of Westminster, and sent to *one* of the museums in Oxford. I have examined *these* collections with Mr. Hugh Strickland, but have not been able to discover it." (Zool. Erebus and Terror, p. 27.) The interest which I had excited by my visit caused the skull to be looked for, and some time after I received through the kindness of Dr. Acland, the Curator of one of these Museums, the skull in question, with permission to describe it; and he, seeing the importance of it to zoology, had casts made of the skull and sent them to the English and Foreign museums. I and all other zoologists cannot but be much obliged to Dr. Acland for the trouble he took to find the skull, and the liberal manner in which he has distributed the casts; but I believe that if it had not been for the information which I had obtained by searching up all the documents connected with the specimen from Mr. Sowerby and M. De Blainville, the skull in question would have been most probably hidden from science until the present time, and perhaps eventually lost; for when Mr. Strickland, Mr. Duncan, Dr. Melville (the Assistant Curator), and I searched for it in the two Oxford Museums, both in the collection and in the store-room, we could not discover, and nobody recollected ever having seen such a specimen.

But in the Catalogue of Cetacea before referred to, printed and sent to Professor Eschricht before his observation was made, I had altered the above-quoted note in the Zoology of the Erebus and Terror, thus: "* * and sent to the Anatomical Museum in Oxford, from whence Dr. Acland kindly sent it me for examination," p. 72.

Thirdly. Professor Eschricht in several papers objects to my having placed the genera *Inia* and *Platanista* in the same group called *Platanistina*, though he allows they are nearly allied: this is entirely a mistake; I have never so placed them. Both in the Essay on the Cetacea in the Zoology of the Erebus and Terror, pp. 25 and 45, and in the Catalogue of Cetacea, pp. 135, 136, which may be regarded as a second edition of the same Essay, each genus is considered as the type of a separate tribe called *Iniina* and *Platanistina*.

BIBLIOGRAPHICAL NOTICES.

The Vegetation of Europe, its Conditions and Causes. By A. Henfrey, F.L.S. London: Van Voorst, 1852.

This little work supplies a deficiency in our popular Botanical literature. Before its appearance there was no book to which a person desirous of knowing something of the geographical distribution of the plants of Europe could refer, and those who were determined to attain a knowledge of that interesting subject of inquiry had to consult many and rare works written in various languages. The modest tone in which the author speaks is deserving of all praise, but we must not allow it to be supposed that the book is really so mere a "rough-draft" as he states it to be. Doubtless a person who has studied the subject in the detail necessary to collect the materials used in it may be led to look upon it as a sketch; but it is so full a sketch as probably to satisfy most readers, since all the more prominent, and therefore the most interesting facts of the subject are very clearly placed before them.

The introductory part, treating of the causes of differences of climate, and of the influences of soils, exposure, &c. on the diffusion of plants, is highly deserving of attention. We think however there is not quite sufficient weight given to the influence of the Gulf-stream on the climate, and therefore the vegetation of the north-western coasts of Europe. We believe that that has by far the greatest influence of any natural cause in producing the high and equable temperature of the western coasts of Britain and Scandinavia; and that if, as has been suggested with much probability, that stream were turned off by an opening through Central America, or by a slight depression of the Mississippi and Mackenzie river-valleys, so as to allow it to take its natural course either into the Pacific Ocean in the one case, or the Arctic Sea in the other, the climate of these coasts would become similar to that of Labrador, and render Britain and much of Scandinavia nearly uninhabitable by restoring them to the state which seems once to have existed, at the time that is, of what geologists call the glacial period.

It is impossible to enter into a description of the contents of such a work as this, which is made up of an enormous mass of facts collected with care and much skill from the writings of those who have treated in detail of the Botanical Geography of their respective countries; neither does it seem desirable to extract isolated parts, since they would convey a very imperfect idea of the whole, for each portion of the book is most closely connected with those which succeed and follow it.

We beg leave to congratulate the author on a great improvement in his style, which, in some of his former productions, was rather dry and unpleasant to read, but here presents his multitude of facts in an interesting and popular, but at the same time sufficiently scientific form. We have no doubt that the readers of his present book will rise from its perusal with a feeling of having derived much pleasure and information from it.

There is an unfortunate error at page 28 (line 12) caused by printing Scotland for Iceland, which may give some little trouble, although the careful reader will immediately detect it. At page 86 there is some confusion concerning the northern limit of the ripening of pears, which the author will do well to correct in his next edition. We do not quite understand what is intended by the statement at page 154, that "the length of Great Britain amounts to 120 geographical miles, of Ireland only to 60; the breadth of the former varies from 15 to 65, and that of Ireland from 20 to 40." A geographical mile is about 2025 yards, or rather less than one English mile and a fifth, and therefore, according to his calculation, Great Britain is not more than about 150 miles in length instead of 600. It has probably originated from adopting the numbers given in some foreign work, where the geographical miles are calculated in accordance with the longer ordinary miles used in the country, apparently about in the proportion of four to one of the English. These however are very minute errors, and cannot detract from the value of the book, which we strongly recommend to our readers.

It is satisfactory to see that this is the first of a series of works on the 'Outlines of the Natural History of Europe,' of which the second, 'On the Natural History of the European Seas,' by Prof. E. Forbes, may be immediately expected. We are not informed of the volumes that are to follow, but judging from the present work, and from Mr. Forbes's known acquaintance with the subject intended to be illustrated by him, we are led to expect that the whole series will form a valuable addition to our popularly-scientific literature.

Conspectus Cyclostomaceorum emendatus et auctus Pneumonopomorum Monographiæ Prodromus, auctore Dr. LUDOVICO PFEIFFER. Cassellis, 1852. 8vo, 74 pages.

This small work is one of the most convincing proofs of the rapid progress of modern conchology. Lamarck described twenty-seven species of the genus *Cyclostoma*; Deshayes added eighteen in his edition of that author, being the last general work on the species of shells up to 1850; they were all included in a single genus.

In the Synopsis of the British Museum for 1840, as our author informs us, Mr. Gray proposed to divide them into genera according to the form of the operculum; Troschel extended the number of the genera; and in 1850 the Trustees of the Museum, under the title of 'Nomenclature of Molluscous Animals and Shells in the Collection of the British Museum. Part I. Cyclophoridæ,' printed a list of the specimens in the collection of that institution with the characters of the new genera.

The above work of Dr. Pfeiffer may be considered as a second or revised edition of that work, with the description of many new species; the species noticed in it amount to 469 divided into 29 genera, arranged in three sections.

It is pleasing to observe the effect which the Catalogues, published by the Trustees of the British Museum, have had on science. The lists of Mammalia and Birds were followed by similar lists of the Mam-

malia, Birds and Reptiles contained in the Frankfort Museum; and the list of Birds forms the basis of a Catalogue of the Collection of Birds in the Philadelphia Museum.

The list of Cetoniadæ was followed by the commencement of a Catalogue of Lamellicornes in the Museum of the Garden of Plants in Paris, and has been revised and extended, and printed in Stettin by Dr. Schaum; and more lately the professors of that Institution have published Catalogues of the Mammalia and Reptiles similar to the second and more enlarged edition of the British Museum Catalogues of these animals; and here we have a list of shells published in Germany like the other work above quoted, most of them avowedly following the lead set them by the Trustees of the British Museum.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

November 26, 1850.—R. H. Solly, Esq., F.R.S., in the Chair.

Synopsis of the species of Deer (Cervina), with the Description of a new species in the Gardens of the Society. By J. E. Gray, Esq., F.R.S. etc.

The Deer, spread over all parts of the Globe, are easily recognized by their deciduous horns, which are covered, when they are first developed, with a hairy skin.

It has been supposed that the Deer were not to be found in Africa, but the discovery of a species in Barbary has dispelled that idea; they are rare in that extensive quarter of the world, their place being supplied by Antelopes.

Since the publication of Cuvier's Essay on Deer, in which he described several species from the study of the horns alone, many zoologists have almost entirely depended on the horns for the character of the species, and Colonel Hamilton Smith has been induced to separate some species on the study of a single horn. But the facilities which menageries have afforded of studying these animals, and watching the variations which the horns of the species present, have shown that several most distinct but allied species, as the Stag of Canada and India, have horns so similar that it is impossible to distinguish them by their horns. On the other hand, it has been shown that animals of the same herd, or even from the same parents, and sometimes even the same specimen, under different circumstances, in succeeding years have produced horns so unlike one another in size and form, that they might have been considered, if their history was not known, as horns of very different species. These observations, and the examination of the different cargoes of foreign horn which are imported for the uses of the cutler, each cargo of which is generally collected in a single locality, and therefore most probably belong to a single species peculiar to the district,—have proved to me that the horns afford a much better character to separate the species into groups, than to distinguish the allied species from one another.

Colonel Hamilton Smith, in his Monograph of the Genus, separated them into subgenera according to the form of the horns.

In the Proceedings of the Zoological Society for 1836 I drew attention to the glands on the hind-legs as affording very good characters to arrange the subgenera proposed by De Blainville and Colonel Smith into natural groups, which in most particulars agreed with the geographical distribution of the species.

Dr. Sundevall, in his Essay on Pecora, has availed himself of the suggestions in my paper, and has also pointed out some other external characters, such as the form and extent of the muffle, which afford good marks of distinction in these animals,—such as I believe are much more important for the distinction of the genera and species than those derived from the form of the skull or the modifications of the teeth, or the form and size of the horns; as they are not, like those parts, so liable to alteration from age, local circumstances and other changes during the growth of the animal, and they can be seen in the females as well as the males, which is not the case with the horns, as they can only be observed in the male sex.

The Deer may be thus divided:

A. The Deer of the Snowy Regions have a very broad muzzle, entirely covered with hair; the horns are expanded and palmated, and the fawns are not spotted.

a. The *Alcine Deer* have no basal anterior snag to the horns, and a small, bald muffle between the nostrils, as the genus *Alces.*

b. The *Rangerine Deer* have a large basal anterior snag to the horns, close on the crown or burr, and no muffle, as *Tarandus.*

B. The Deer of the Temperate or Warm Regions have a tapering muzzle, ending in a bald muffle; the fawn, and sometimes the adult, are spotted.

c. The *Elaphine Deer* have a distinct anterior basal snag to the horns, the muffle broad, and separated from the lip by a hairy band, and the tuft of hair on the outside of the hind-leg above the middle of the metatarsus, as *Cervus* and *Dama.*

d. The *Rusine Deer* have a distinct anterior basal snag to the horns, the muffle very high, and not separated from the edge of the lip, and the tuft of hair on the outside of the hind-leg above the middle of the metatarsus, as *Recervus, Panolia, Rusa, Axis, Hyelaphus,* and *Cervulus.*

e. The *Capreoline Deer* have no basal anterior snag to the horn, the first branch being some distance above the burr; the suborbital crumen (and pit in the skull) generally small, as *Capreolus, Cariacus, Blastocerus, Furcifer,* and *Coassus.*

The *Alcine* and *Rangerine* Deer are confined to the Northern part of both continents; the *Elaphine* and *Rusine* Deer to the Eastern World, the latter almost exclusively to the warmer part of Asia; the *Capreoline* Deer are peculiar to America. The only exception to these rules are, the Wapiti Deer of the Elaphine group is found in Northern America, and the *Roebuck* and *Ahu* of the *Capreoline* group are found in Europe and North Asia.

A. The Deer of the Snowy Regions have a very broad end to the nose, which is entirely covered with hair, a short tail and palmated horns; the fawns are not spotted, but uniformly coloured like the adult; the skull with a large nose-cavity, and with the intermaxillaries not reaching to the nasal.

a. The Alcine Deer or Elks have no basal snag, the first branch of the horn being considerably above the crown.

1. Alces; *Alce*, H. Smith.

The muzzle is very broad, produced, and covered with hair, but there is a small, moist, naked spot in front of the nostrils; the neck is short and thick; the hair is thick and brittle; the throat is rather maned in both sexes; the hind-legs have the tuft of hair rather above the middle of the metatarsus; the males have palmate horns. The nose-cavity in the skull is very large, reaching behind to a line over the front of the grinders; the intermaxillaries are very long, but do not reach to the nasal; the nasals are very short. They live in woods in the northern parts of both continents.

1. Alces malchis. The Elk or Moose.

Dark brown; legs yellower.

Alces, Gesner; Plin.—*Cervus Alces*, Linn. S. N. i. 92; Pallas, Zool. R. A. i. 201; H. Smith; Richardson, Fauna Bor. Amer. 232.—*Alces Malchis*, Ogilby, P. Z. S. 1836, 135; Gray, Knows. Menag. 56.—*Moose Deer*, Dudley, Phil. Trans. n. 368. 165.—*Elk*, Laws, Carol. 123; Pennant, Syn.—*Elan*, Brisson, H. N. xii. t. 7. Supp. vii. t. 25; Cuvier, R. A.—*Orignal*, La Houtan, Voy. 72; Charlev. Nouv. France, iii. 126.—*American Black Elk* (*C. alces* β.), H. Smith, G. A. K. v. 771.—*Loss*, Russians in Siberia.

Inhabits the Northern regions of America and Europe.

Several naturalists, especially Colonel Hamilton Smith, thought they had observed a difference in the horns of the Russian and American Elks; I have compared numerous specimens from both countries, but can discover no appreciable distinction between them.

The Elks, like most of the other Deer, and especially of the animals which inhabit the cold and mountain regions, present a very considerable difference in size, according to the scarcity or abundance of the food which the locality they inhabit affords, and the development of the horns appears to be greatly influenced by this cause; so that the horns of the animals inhabiting the more barren districts are much less developed than those found in more fertile situations, and I think I have observed this to be the case with both the Russian and the American horns: but on this head naturalists are like to be much misled, as the horns which are imported are generally chosen for their size and perfect development, and the small and less-developed specimens are only to be observed in the cargoes of horns which are imported for economic purposes.

These observations are equally applicable to the *Rein Deer*.

b. The Rangerine Deer or Reins have a large and well-developed basal branch close on the crown of the horns.

2. Tarandus; *Rangifer*, H. Smith.

The muzzle is entirely covered with hair; the tear-bag small, covered with a pencil of hairs; the fur brittle, in summer short, in winter longer, whiter, of the throat longer; the hoofs are broad, depressed, and bent in at the tip; the external metatarsal gland above the middle of the leg; horns in both sexes elongate, subcylindric, with the basal branches and tip dilated and palmated; of the females smaller; skull with rather large nose-cavity, about half as long as the distance to the first grinder; the intermaxillary moderate, nearly reaching to the nasal; a small, very shallow, suborbital pit.

They live in the Arctic Regions in both hemispheres, migrating in flocks, and eating lichens.

1. Tarandus rangifer. The Caribou or Rein Deer.

Dark brown in summer, grey in winter. Young: brown, yellow varied.

Tarandus, Plini.—*Rangifer*, Gesner.—*Cervus Tarandus*, Linn.; Pallas, Zool. Ross. A. i. 106; Cuvier, Mamm. Lith. t. ; Bennett, Gardens Z. S. 241. fig.; Richardson, Fauna Bor. Amer. 238.—*C. Tarandus sylvestris* (*Woodland Caribou*), Richardson, Fauna Bor. Amer. 250.—*C. rangifer*, Raii Syn. 88.—*C. platyrhynchos*, Vrolich, Rendier, t. 2 (1828).—*C. palmatus* and *C. mirabilis*, Jonston, Quad. t. 36, 37.—*Tarandus rangifer*, Gray, Knows. Menag. 57.—*Rein Deer*, Pennant.—*Caribou*, Sagard. Theodat. Canad. 751.—*Renne*, Buffon, H. N. xii. 79. t. 10–12. Supp. iii. t. 18*.—*Rhenne*, Cuvier, R. A.—*Caribou* or *Carrebœuf*, French Canadians.—*Oleen*, Russians in Siberia.

Var. Smaller; horns more slender, less palmated; hair short, smooth, close, brown, with throat and belly white in summer; hair very close, thick, waved, brittle and erect and white in winter.

Cervus Tarandus Americanus, H. Smith, G. A. K. v. 773.—*C. Tarandus v. Arctica* (*Barren-ground Caribou*), Richardson, Fauna Bor. Amer. 241. fig. 240, horns.—*Common Deer*, Hearne, Journ. 195. 200.

Inhabits Arctic parts of Europe and America.

Varies exceedingly in size. In the British Museum there are specimens varying from 20 to 28 inches high at the withers, and proportionally as large in the horns and all the other parts. The variety is confined to the barren grounds.

Dr. Richardson observes, "There are two well-marked and permanent varieties of *Caribou* that inhabit the fur countries; one of them (*Woodland Caribou*) confined to the woody and more southern districts, and the other (*Barren-ground Caribou*) retiring to the woods only in the winter, but passing the summer on the coasts of the Arctic seas, or on the barren grounds so often mentioned in this work."—*Fauna Bor. Amer.* 299.

The large Siberian variety are ridden on by the Tungusians. They also use them for draught, as the Laplanders do the smaller variety.

They have a large variety in Newfoundland, nearly as large as a heifer, having very large and heavy horns. There are some horns of this variety in the British Museum. M. Middendorf informed me that the horns of the large Siberian variety were as large as, and greatly re-

sembled, the horns from Newfoundland (Nova Scotia) in the British Museum Collection.

Pallas observes, "Americæ forte continua gregatim verno tempore per glacies admigrant, paulo diversi a Siberiæ inquilinis et verosimillime Americani."—*Zool. Ross. Asiat.* i. 208.

B. The DEER OF THE WARM OR TEMPERATE REGIONS have a tapering nose, ending in a naked, moist muffle; they generally have a well-developed tail, distinct crumen, and rather long false hoofs; their fawns are spotted, the spots generally disappearing in the adult, or only to be seen when the animals are in high condition; the fur is shorter and fulvous in the summer, becoming longer and greyer in the winter; the skulls have a moderate nose-cavity, and the intermaxillaries reaching to or nearly to the nasal bones.

c. The ELAPHINE DEER or STAGS have a low, broad muffle, narrowed and rounded below, and nearly separated from the edge of the lip by a hairy band, which has only a narrow interruption in the middle, and rather elongated ears; they have rough horns, generally supported on a more or less long process of the frontal bones, furnished with a frontal basal branch or snag close on the burr or crown; the outer side of the hind-legs has a tuft of hair placed rather above the middle of the metatarsus, and another tuft on the inner side of the hock.

They are (except the *Wapiti*) exclusively confined to the woods of the Old or Eastern World.

3. CERVUS; *Elaphus*, H. Smith; *Cervus* and *Pseudocervus*, Hodgson.

Horns round, erect, with an anterior basal snag, a medial anterior snag, and the apex divided into one or more branches, according to the age of the animal; a well-developed crumen; narrow triangular, compressed hoofs; they are covered with brittle, opake hairs; the rump is generally ornamented with a pale mark; skull with a large, deep, suborbital pit.

* The *True Stags* have one or two branches on the middle of the front of the beam.

† The *American kind* have rather broad semicircular hoofs, a very short tail, and the withers covered with softer hair in winter. *Strongyloceros.*

1. CERVUS CANADENSIS. The WAPITI.

Red-brown; rump with a very large pale disk extending far above the base of the tail, and with a black streak on each side of it; male with hair of throat elongated, black, with reddish tips.

Stag, Dale, Phil. Trans. n. 444, 384.—*Cerf de Canada*, Perr. Anim. ii. 55. t. 45?; Cuvier, R. A. i. 256.—*Cervus Canadensis*, Brisson; Gray, Knows. Menag. 58.—*Cervus Elaphus, var. Canadensis*, Erxl.—*Cervus Strongyloceros*, Schreb. t. 247; Richardson, Fauna Bor. Amer. 251.—*C. major*, Ord.—*C. Wapiti*, Leach, Journ. Phys. lxxxv. 66.—*American Elk*, Bewick, Quad.—*North-Western Stag, C. occidentalis*,

H. Smith, G. A. K. iv. 101. t. . f. 2, horn; Fischer, Syn. Mamm. 614, not Syn.—*Wapiti*, Warden, États Unis, v. 638; Wied, Voy. Amer. Sept. iii. 302.

Var. Smaller.

Red Deer (or *Canadian Stag*), Warden, États Unis, v. 637.—*Elk*, Lewis and Clerk.—*Stag*, Pennant, Arct. Zool. i. 27.—*Wewaskiss*, Hearne, Journ. 360.

Inhabits N. America.

In summer red-brown; ears, middle line of the back of the neck, and back of rump and front of legs blackish; rump-mark yellowish.

†† The species of the *Western World* have narrow, triangular hoofs, a moderate tail, and are covered with harsh hair. *Cervus.*

2. Cervus Elaphus. The Stag.

Brown; rump with a pale spot extending rather above the upper surface of the base of the tail.

Cervus, Plin.; Gesner.—*Tragelaphus*, Gesner (old male).—*Cervus Elaphus*, Linn.; Gray, Knows. Menag. 58.—*C. vulgaris*, Linn.—*C. nobilis*, Klein.—*C. Germanicus*, Brisson.—*C. Elaphus β. Hippelaphus*, Fischer, Syn. (old male).—*Stag, or Red Deer*, Pennant.—*Cerf*, Buffon, H. N. vi. t. 9.—*Cerf commun*, Cuvier; F. Cuvier, Mamm. Lith. t. .

Inhabits Europe.

Mr. Blyth described a variety as the *Hungarian Stag* (Mus. Asiat. Soc. Beng. 1841, 750. t. 3. f. 11).

The Deer which Buffon (H. N. vi. 95. t. 11) describes under the name of the *Cerf de Corse*, has been regarded as a variety to be distinguished by the smallness of its size, but Buffon observes, that he believes the "size to depend on the scarcity of nourishment; for when moved to better pastures, in four years they became higher, larger and stouter than the Common Stags."

3. Cervus Barbarus. The Barbary Deer.

Dark brown; obscurely white spotted, with a very indistinct, greenish brown, broad dorsal line, with a pale yellow spot extended considerably above the base of the tail; back of haunches white, with a dark stripe on each side.

Cervus Barbarus, Bennett, MSS. Catal. Gardens Zool. Soc.; Gray, Knows. Menag. 59; Frazer, Zoologia Typica, t. .—*Burk-Goat* (*Ál-Wassai*), Moors (see Griffith, A. K. v. 775).

Inhabits Coast of Barbary; Tunis.

4. Cervus Wallichii. The Bara Singa or Morl.

Brown, with a very large white spot on the rump, extending on back of the haunches and far above the base of the tail; the horns with two basal and one or two apical branches.

Cervus Pygargus, Hardw. Linn. Trans.—*Cervus Wallichii*, Cuvier, Oss. Foss. iv. 50; F. Cuv. Mam. Lith. from Hardw. Icon.; Sundev. Pecora, 55; H. Smith, G. A. K. iv. 103. t. . (from Indian drawing); Gray, Knows. Menag. 60.—*Jaareel Stag*, Blyth, Journ. Asiat. Soc. Bengal, 1841, 750. t. . f. 7, young horn; Hodgson, Icon. ined.

t. 198, called *Gyana.—Pseudocervus Wallichii,* Hodgson, Journ. Asiat. Soc. Bengal, x. 914, xi. 284.—?*Cervus Caspianus* or *Hangool,* Falconer, MSS.; Gray, Cat. Osteol. Sp. B. M. 147.—?*Cervus Cashmeriensis,* Gray, Cat. Osteol. Sp. B. M. 65.—*Kashmir Stag*?, Blyth, P. Z. S. 1840, 72; Journ. Asiat. Soc. Bengal, 1841, 750. t. . f. 8, 9. —*Persian Deer, Maràl* or *Gevezu* or *Gookoohee,* MacNeil, P. Z. S. 1840, 11; Blyth, Journ. Asiat. Soc. Bengal, 1841, 750. t. . f. 10.

Inhabits Cachir (*Hodgson*); Persia (*MacNeil*).

The skull of Dr. Falconer's *Cashmere Stag* is 15 inches long; the suborbital pit is oblong, triangular, and rather deep. The skull and horns are very like Mr. Hodgson's specimen of *Cervus affinis,* but they are considerably smaller.

Sir John MacNeil informs us they are called by the Persians *Maràl,* or *Gevezu,* or *Gookoohee,* and are frequently noticed in their literature. It is found in all the wooded mountain districts of Persia, but apparently does not occur in the central parts of the country. They rarely descend into the plains. During the summer they are found in the highest wooded parts of the mountains, and during the winter in the lower ravines, near their bases, where they are frequently tracked in the snow. The horns of the adult males closely resemble those of the Red Deer of this country; insomuch that I doubt whether an unscientific observer could distinguish them, except by the superior size of those of the *Maràl.—P. Z. S.* 1840, 11.

5. Cervus affinis. The Saul Forest Stag.

Pale brown; rump without any distinct pale mark?; skull 16 or 17 inches long; suborbital pit large, oblong, trigonal, rather deep.

Cervus affinis (*Mool Baratingha, or Royal Stag of the Morung*), Hodgson, Icon. ined. B. M. n. 197; Journ. Asiat. Soc. Bengal, x. 741, 914; Calcutta Journ. N. H. iv. 291; Sundev. Pecora, 131; Gray, Cat. Ost. Sp. B. M. 65; Knowsley Menag. 60.—*C. Elaphus,* Hodgson, Journ. Asiat. Soc. Bengal, iv. 648.—*C. Wallichii,* part, Gray, Cat. Hodgson's Coll. in B. M. 32.—*C. Wallichii, var.* Blyth, Journ. Asiat. Soc. Bengal, 1841, 747.

Inhabits India; Saul Forest.

Mr. Hodgson, in his figure of this animal, does not represent any pale spot on the rump: if this is correct, it must be a most distinct species, as Dr. Falconer informs me the *Cashmere Stag* has a large white rump.

6. Cervus Sika. The Sika.

Dark brown; cheeks and throat rather paler; rump brown, without any pale spot; tail pale, white beneath; hair harsh; horns rather slender, with a basal and medial snag, and a subapical internal one.

Cervus Sika, Schlegel, Fauna Japon. t. 17; Sundev. Pecora, 55, 131; Gray, Knows. Menag. 60.—*C. Sitza,* Temm. Mus. Leyden.

Inhabits Japan. Mus. Leyden.

4. Dama, H. Smith; *Platyceros.*

Horns, upper part expanded, smooth, and branched on the hinder edge; tail rather elongated; tear-bag well developed; hoofs narrow,

triangular, compressed; they are covered with thin, rather adpressed hairs, and have the hair of the nape reversed; the fur is spotted in summer; the skull with a short broad face, an oblong, rather shallow, infraorbital pit; intermaxillary broad, reaching to the short broad nasals.

1. Dama vulgaris. The Fallow Deer.

Fulvous; white spotted, with the longitudinal streak on the lower part of the side, and the line across the haunches white.

Var. From nearly black to nearly pure white.

Platyceros, Plini.—*Cervus platyceros,* Raii Quad. 85.—*Cervus dama,* Linn.—*Dama vulgaris,* Gesner, Quad. 335. f. ; Gray, Cat. Osteol. Sp. B. M. 65; Knows. Menag. 60.—*Fallow Deer and Buck,* Pennant.—*Daim et Daime,* Buffon.—*Daim fauve,* F. Cuvier.—*Cervus coronatus,* H. Smith, G. A. K. iv. t. . f. 4, from monstrous horns.

Var. Blackish.

Cervus mauricus, F. Cuv. Bull. Soc. Phil. 1816.—*C. Dama maura,* Fischer.—*Daime noire,* F. Cuv. Mam. Lith.

Inhabits Persia. Domesticated in Europe.

This species is represented in the sculptures from Nineveh.

d. The Rusine Deer or Samboos have a large moist muffle, which is as high as broad, and extends to the edge of the upper lip; hind-leg with a large tuft of hair rather above the middle of the metatarsus, and with a pencil of hair on the inner side of the hock; a moderate tail, broad, short ears, and the fur consisting of hard, rather shining, thick, depressed hair; they have no white mark on the rump. The horns are cylindrical, generally rather longly peduncled, with a distinct anterior basal branch or snag close on the burr or crown, and are forked, and sometimes reforked, at the tip; they have no medial snag. The skulls have a large, very deep, suborbital pit. They are confined to South-Eastern Asia and its islands.

* In some the upper part of the horns is variously branched.

5. Panolia, Gray.

The horns round, curved backwards and outwards, with a large anterior basal snag close on the burr; the upper part bent in, forked, becoming rather expanded and branched on the inner or hinder edge; the fur formed of rather rigid, flattened hair; muffle large; skull with a narrow face, a large, oblong, very deep suborbital pit, and the nasals short, broad, and dilated behind; the frontal snag of the horns often has a tubercle or branch at the base.

1. Panolia Eedii. The Sungnai.

Panolia Eedii, Gray, Cat. Hodgson's Coll. B. M. 34; Knowsley Menag. 61.—*P. acuticornis,* Gray, Cat. Mam. B. M. 180.—*P. platyceros,* Gray, Cat. Mam. B. M. 180 (adult horn).—*Cervus lyratus,* Schinz, Syn. ii. 395.—?*Cervus Smithii,* Gray, Proc. Zool. Soc. 1837, 45.—*Cervus Eedii,* Calcutta Journ. N. H. ii. 413. t. 12.—*Cervus* (*Rusa*) *frontalis,* M'Clelland, Calcutta Journ. N. H. i. t. 12. f. 1, ii. 539, iii. t. 13; Sundevall, Pecora, 132.

Inhabits India.

General Hardwicke has a drawing of a Deer, the frontal snag of the horns very much elongated, and apparently forked: Colonel Hamilton Smith made an "improved" drawing from the sketch; and in the Proceedings of the Zoological Society for 1837 I mention the species under the name of *C. Smithii*, p. 48.

I am now doubtful if the sketch might not have been intended for this species or a new one allied to it.

6. RUCERVUS, Hodgson; *Rusa*, sp. H. Smith.

Horns cylindrical, with an anterior basal branch, and repeatedly forked at the tip; muffle large, high, continued to the edge of the upper lip below; they have a rather short, thick tail, a shortish face, a well-developed crumen, broad rounded ears, covered with hair, and narrow compressed hoofs. The fur is formed of rather soft adpressed hairs; they have no pale mark on the rump, and are indistinctly spotted. The skull has an elongate face, with a large nose-opening, and an oblong, rather shallow, suborbital pit.

1. RUCERVUS DUVAUCELLII. The BAHRAIYA.

Yellowish brown, without any rump-spot; back with an indistinct dark streak, with a row of white spots on each side; sides not spotted; hair black, with yellow tips; neck with rather longer hair; throat, chest and belly with longer, scattered, greyish white hairs; muzzle and front of leg dark; chin white. Fur in winter dark brown.

Cervus Duvaucellii, Cuvier, Oss. Foss. iv. t. 29. f. 6, 8.—*Rucervus Duvaucellii*, Gray, Cat. Hodgson's Coll. B. M. 33.—*Rucervus elaphoides*, Hodgson.—*R. Duvaucellii*, Gray, Knows. Menag. 61.—*Cervus Bahrainja*, Hodgson.—*C. enclodocerus*, Hodgson.—*C. Bahraiya*, Hodgson, P. Z. S. 1836, 46.—*C. Euryceros*, Knowsley Menag. t. 40, 41.—*Bahraiya*, Hodgson.

Inhabits India.

* The *True Rusas* have the upper part of the horns simply forked.

7. RUSA, H. Smith; *Cervus Hippelaphi***, Sundevall.

They are covered with hard, rigid, very thick hairs; they are not, or only obscurely, spotted; the horns are placed on a moderately long peduncle, have an anterior frontal snag close on the crown, and are simply forked at the tip.

† The *Larger kinds* have the hair of the neck elongated, forming a kind of mane, at least in the males.

1. RUSA ARISTOTELIS. The SAMBOO.

Tail not floccose, brown, rather darker at the end; blackish brown, with the feet, the region of the vent, and a spot over the eyes fulvous. Male maned. Young obscurely white spotted (*Hodgson*).

Gona Rusa, Daniel, Ceylon, t. .—*Cervus Aristotelis*, Cuvier, Oss. Foss. iv. 502. t. 39. f. 10; F. Cuv. Mam. Lith. t. ; Sundev. Pecora, 55.—*Cervus Hippelaphus*, *C. Aristotelis*, and *C. heteroceros*, Hodgson, Icon. ined.—*Rusa Aristotelis*, H. Smith; Gray, Cat. Hodgson's Coll. B. M. 67; Osteol. Spec. B. M. 67; Knows. Menag.

62.—*Cervus unicolor*, H. Smith, G. A. K. v. 780.—*Cervus Bengalensis*, Schinz, Syn. Mam. ii. 390.—*Daim noir de Bengal*, Duvaucell, Asiat. Res. xv. 157.—*Cerf noir de Bengal*, F. Cuvier, Menag. Lith. t. .—*Cervus equinus* (*Samboo Deer*), Bennett, Tower Menag. 185, fig.—*Elk*, Indian Sportsmen ; Sykes, Proc. Zool. Soc.—Var. *Cervus heteroceros*, Hodgson, J. A. S. Beng. 1841, 722. t. .

Var.? *Biche de Malacca*, F. Cuv. Mam. Lith. t. female.—*Cervus Malaccensis*, Fischer, Syn.

Inhabits India ; Ceylon.

The skull is about 17 inches long, and has a very deep, oblong, subtriangular, suborbital pit.

The specimen from Ceylon, in the Zoological Gardens, differs from the common Samboos from India in having shorter and thicker horns.

Nearly black in October ; the front of the muzzle rounded, the nose black, forming a band across the chin ; front of chin (only) white ; tail all black ; face paler than back, and more grisled, but uniformly coloured, without any black streak over the eyes or up the side of the nose ; vent flesh-coloured. Much larger.

2. Rusa Dimorphe. The Spotted Rusa.

Red-brown ; back with distinct series of small white spots ; sides indistinctly white spotted ; limbs paler ; neck and belly blackish ; chin white ; the horns (deformed?). Young bright fawn-red, white spotted.

Cervus Dimorphe, Hodgson, Journ. Asiat. Soc. Bengal, 1844, t. ; Ann. & Mag. Nat. Hist. xiv. 74 ; Sundevall, Pecora, 132.—*Rusa Dimorpha* (*Hodgson's Rusa*), Hodgson in Gray, Cat. Hodgson's Coll. in B. M. 33 ; Gray, Knows. Menag. 62.

Inhabits Saul Forest ; Morang.

3. Rusa Equinus. The Rusa or Smaller Samboo.

Brown, not spotted ; tail rounded, floccose, black at the tip ; hair (summer) elongate, rigid, thick, waved. Young very obscurely spotted ; hair rigid and rough.

Rusa, Raffles, Linn. Trans. xiii. 263.—*Cervus equinus*, Cuvier, Oss. Foss. iv. 44. t. 5. f. 30, 37, 38, 42 ; H. Smith, G. A. K. iv. 112. t. ; Sundevall, Pecora, 55 ; S. Müller, Nederl. Verh.—*Eland* or *Elk* of the Dutch Sportsmen.—*Rusa Equinus*, Gray, Knows. Menag. 62. t. 43.

Inhabits Sumatra ; Borneo.

4. Rusa Hippelaphus. The Mijangan Banjoe.

Greyish brown ; tail not floccose, brownish at the tip ; anal region not pale ; cheeks and upper part of the neck of the males maned ; hair (summer) short, rigid, close-pressed, not waved. Young : hair smooth.

Rusa ubi, *R. saput* and *R. Tunjuc*, Raffles, Linn. Trans. xiii. 260. —*Cervus hippelaphus*, Cuvier, Oss. Foss. iv. t. 5. f. 31, 34 & 42 ; F. Cuvier, Mam. Lithog. t. ; Raffles, Mem. 645.—*Cervus Tunjuc*, Vigors, in Raffles' Memoir, 645.—*Cervus Rusa*, S. Müller, Nederl. Verh. 45. t. 43.—*Great Muntjac*, Waterhouse, Cat. Mus. Zool. Soc. 1839, 39.—*Cerf noir de Bengal*, F. Cuvier, Mam. Lithog. t. 2, in

summer.—*Cervus Leschenaultii,* Cuvier, Oss. Foss. v. , from horns only.—*Rusa Hippelaphus,* Gray, Knows. Menag. 62.

Var. Smaller. Eydoux, Guérin, Mag. Zool. 1836, 26.—*Cervus Moluccensis,* Quoy.—*Cervus Rusa Moluccensis,* S. Müller, Nederl. Verh. t. 45; Mus. Leyden, 1845.—*Cervus Rusa Timorensis,* Mus. Leyden, 1845.

Inhabits Java.

In all its states it was very distinct from the Samboo of Continental India. The horns are similar to those of *R. Equinus,* but the body and horns are smaller, and the hair of the young is smoother.

** The *Smaller Rusas* have no mane; the peduncles of the horns are rather elongated, and covered with hair.

5. Rusa Peronii. The Smaller Rusa.

Brown, paler beneath; hair rigid, thick, ringed; muzzle dark; tail brown, floccose; anal disk white; the hind part of the feet hairy; the horns are thick and heavy.

Cervus Peronii, Cuvier, Oss. Foss. iv. 46. t. 5. f. 41, 45; Sundev. Pecora, 56.—*Rusa Peronii,* Gray, Knows. Menag. 63.—*Cervus Kuhlii,* S. Müller, Nederl. Verh. 45. t. 44; Sundev. Pecora, 56.—*Rusa Kuhlii,* Gray, List. Osteol. Spec. B. M. 68.

Inhabits Timor, Luboc, Bavian and Ternate. Specimen in Brit. Mus.

6. Rusa Philippinus. Philippine Rusa.

Forehead brown; end of nose and eyebrows brownish; feet behind naked; hair rigid, not waved.

Cerf de Philippine, Desm. Mamm. 442.—*Cervus Philippinus,* H. Smith, G. A. K. iv. 147. t. 164. f. 5. head, v. 803; Fischer, Syn. 622; Sundev. Pecora, 56.—*Rusa Philippinus,* Gray, Knows. Menag. 63.

Var.? Tail black, dependent; front of face dark.

Cervus Marianus, Cuvier, Oss. Foss. iv. 45. t. 5. f. 30, 37, 38, 46; H. Smith, G. A. K. iv. 115. t. 168 (from Mus. Paris); Fischer, Syn. 453; Sundev. Pecora, 57.

Inhabits Philippines.

This species has the horn on an elongated peduncle, like the *Muntjacs,* but it is easily distinguished from them by the absence of the ridge and of the grooves on the face.

7. Rusa lepida. The Little Rusa.

"Reddish brown; back and sides varied with pale, spotted hair; vent disk small, white, black edged above; tail longly hairy, white, above black; face brown, with a roundish white spot in front of the usual oval black spot; horns smooth, slender, nearly straight, elongate, the basal snag bent down on the forehead."—*Sundevall.*

Cervus (*Hippelaphus*) *lepida,* Sundev. Pecora, 57.—*Rusa lepida,* Gray, Knows. Menag. 63.

Inhabits Java. Mus. Frankfort. Scarcely as large as a Roebuck.

8. Axis, H. Smith; *Hippelaphus* ***, Sundev.

Covered with moderately thick, polished hairs; fulvous and beauti-

fully white spotted at all seasons; the face is elongate, narrow, and the ears large, rather elongate and acute, with a rather elongate tail, and nearly equally long, slender legs; the horns are placed on moderately long peduncles; the skull is elongate, narrow, with an oblong, rather small, deep suborbital pit.

1. Axis maculata. The Axis or Chiltra.

Fulvous, with a black dorsal streak, edged with a series of white spots; sides with many white spots in an oblique curved line, and with a short white streak obliquely across the haunches.

Young fawn, spotted exactly like the adult.

Axis, Plin.?; Buffon, H. N. xi. t. 38, 39; Cuvier, Menag. Mus. t. ; Oss. Foss. iv. 38. t. 5. f. 24, 29.—*Cervus Axis*, Erxl.; Schreb. t. 250; Bennett, Gard. Zool. Soc. 253; Sundev. Pecora, 57.—*Axis maculata*, Gray, Cat. Mamm. B. M. 178.—*A. major*, Hodgson, Journ. Asiat. Soc. Bengal, x. 914.—*A. minor*, Hodgson, Journ. Asiat. Soc. Bengal, x. 914.—*A. medius*, Hodgson, Icon. ined.—*Cervus pseudaxis*, Gervais, Voy. Bonite, 64. t. 12; Institute, 1841, 419; Sundev. Pecora, 57.—*C. Axis Ceylonensis*, H. Smith.

Var. Blackish. *Cervus nudipalpebra*, Ogilby, P. Z. S. 1831, 136; Sundev. Pecora, 57. 131.

Inhabits India.

The horns of this species vary greatly in size. Pennant describes two Deer under the names of 1. *Greater Axis*, Pennant, Syn. 52; Quad. 106 = *Cervus Axis* γ, Gmelin; 2. *Middle-sized Axis*, Pennant, Quad. 106 = *Cervus Axis* β, Gmelin, from the horns alone: these are probably only large-horned examples of the common species; 3. *C. pseudaxis*, which has been regarded as a species of *Rusa*, is only a small-horned variety.

9. Hyelaphus, Sundev.; *Axis*, sp. H. Smith.

Covered with moderately thick, polished hair; fulvous, and spotted in the summer; with a rather elongated tail, and rather short legs, the front being rather the shortest; the face is short, broad, and arched in front; the ears short and rounded; the horns are placed on moderately long peduncles.

1. Hyelaphus porcinus. The Lugna Para or Shgoriah.

Brown or yellowish brown, with an indistinct darker dorsal streak, and with obscure whitish spots, but without any white streak on the sides or haunches; in the winter brown and spotless; front of face and legs darker; line down the front and the inside of the thighs white.

Porcine Deer, Pennant, Syn. 42. t. 8. f. 2.—*Cerf Cochon*, Buffon, Supp. iii. 122. t. 18 (in summer).—*Cervus porcinus*, Zimmerm.; Schreb. t. 251; F. Cuvier, Mamm. Lithog. t. .—*Hyelaphus porcinus*, Sundev. Pecora, 58; Gray, Knows. Menag. 64. t. 42; Cat. Ost. B. M. 67. —*Axis porcinus*, Hodgson, Journ. Asiat. Soc. Bengal, x. 914; Gray, Cat. Hodgson's Coll. B. M. 33.—*Cervus niger*, Hamilton, Icon. ined.; Blainv. Bull. Soc. Philom. 1816, 76; Fischer, Syn. 454; Sundev. Pecora, 60. 132.

Inhabits India.

Easily known from the *Axis* by being lower on its legs, and there is no distinct black dorsal streak, nor white streak on haunches; the tail bushy, and often carried erect: the males and females in summer are reddish brown, with numerous white spots, the middle of the back rather darker; in winter the whole fur becomes blackish brown, and the spots disappear: the horns are generally short, with only short snags or branches, but they are sometimes as large as those of the *Axis Deer*.

10. CERVULUS, Blainv. 1816; *Muntjacus*, Gray, 1821; *Stylocerus*, H. Smith; *Prox*, Ogilby, Sundev.

Horns on elongated pedicels, supported by longitudinal ridges on the face, which have a naked, moist groove on their side; the canine teeth are exserted; the tear-bags are large and deep; the tail elongate and tufted; the hoofs triangular, and partly united in front by a web; the false hoofs are small and transverse; they are covered with thin shining hair, and are not spotted; they have no tuft of hair on the hind-legs; skull with a very large, deep, nearly hemispherical suborbital pit.

1. CERVULUS VAGINALIS. The KIJANG or MUNTJAC.

Dark reddish brown; narrow streak on the front edge of the thigh white.

Kijang, Marsden, Sumatra, 94.—*Cervus Muntjac*, Zimm. Schreb. t. 254; Horsfield, Java, vi. t. 1; Raffles, Mem. 645.—*Prox Muntjac*, Sundev. Pecora, 61.—*Cervus vaginalis*, Bodd, Elenc. i. 136.—*C. subcornutus*, Blainv. Schreb. t. 254 B. f. 2.—*Muntjacus vaginalis*, Gray, Cat. Mamm. B. M. 173.—*Cervus aureus*, H. Smith, G. A. K. iv. 148. t. . v. 805.—*Ribbed-face Deer*, Penn.—*Chevreuil des Indes*, Allam, Buff. Supp. v. 41. t. 17, vi. 195. t. 26; Cuvier, Oss. Foss. iv. t. 5. f. 48, t. 3. f. 49, 54.—*Cervulus vaginalis*, Gray, Knows. Menag. 65.

Inhabits Sumatra; Java.

This chiefly differs from the following in being darker-coloured.

2. CERVULUS MOSCHATUS. The KEGAN or KAKER.

Bright reddish yellow; streak on front of thigh and under part of the tail white; chin and gullet whitish; hair not ringed.

Var. With a triangular white spot on each side of the chest.

Musk Deer of Nepal, Ouseley, Orient. Collect. ii. t. .—*Cervulus moschatus*, Blainv. Bull. Soc. Phil. 1816, 77; Schreb. t. 254 B. f. 1; H. Smith, G. A. K. iv. 149. t. . v. 806.—*Cervus moschus*, Desm. Mamm. 441.—*C. Ratwa*, Hodgson, Journ. Asiat. Soc. Bengal, i. 146. t. head; P. Z. S. 1834, 99; Royle, Flora Cashm. t. 5. f. 2.—*Stylocerus Ratwah*, Hodgson, Journ. Asiat. Soc. Bengal, x. 914.—*Muntjacus vaginalis*, part, Gray, Cat. Hodgson's Coll. B. M. 31.—*Prox Ratwa*, Sundev. Pecora, 62.—*P. albipes*, Wagner, Suppl.; Sundev. Pecora, 62.—*P. stylocerus*, Wagner, Suppl.; Sundev. Pecora, 62, 64. —*Cervus melas*, Ogilby.—*Prox melas*, Sundev. Pecora, 62.—*Cervulus moschatus*, Gray, Knows. Menag. 65.

Inhabits India, Nepal.

3. Cervulus Reevesii. The Chinese Muntjac.

Greyish brown; hair short, paler ringed.

Cervus Reevesii, Ogilby, P. Z. S. 1838, 105.—*Prox Reevesii*, Wagner, Sundev. Pecora, 62.—*Cervulus Reevesii*, Gray, Knows. Men. 65.

Inhabits China.

Mr. Ogilby observes, this species has a longer head and tail than the Common Indian Muntjac, also less red and more blue in the general shades of colouring, and is readily distinguished by the want of the white over the hoofs, which is so apparent in its congeners. The fawn is spotted.

The Earl of Derby has these three kinds at Knowsley; but they breed together, and it has hence become impossible to discriminate the mules from the original species.

e. The Capreoline Deer or Roes have rugose, very shortly peduncled horns, without any basal snag or branch; the first branch arising some distance above the crown or burr; the upper part is more or less branched; the muffle is broad and naked; the suborbital gland and the pit in the skull are very small and shallow, except in *C. Pudu*. Some species have a distinct tuft of hair on the outer side of the metatarsus, and more have the pencil of hair on the inner side of the hock, and others are without either; indeed in some specimens of the same species the tuft of hair on the hinder legs is very visible, in others very indistinctly or not at all seen.

11. Capreolus, H. Smith; *Capræa*, Ogilby.

Horns nearly erect, small, cylindrical, slightly branched, with a very short peduncle; they have no tail, but a large, white anal disk, a very indistinct tear-bag, and narrow triangular hoofs; the tuft on the hind-legs rather above the middle of the metatarsus; they are covered with thick brittle hair in winter, and thinner and more flexible hair in the summer; the adults are not spotted, and have a black spot at the angle of the mouth; the skull has a very small, shallow suborbital pit. Found in Europe and North Asia.

1. Capreolus Capræa. The Roebuck.

Inside of the ears fulvous; summer, red brown; winter, olive, pale punctated; horns short.

Capræa, Plin.; Gesner.—*Capreolus*, Brisson.—*Cervus capreolus*, Linn.; Pallas, Zool. Ross. A. i. 219.—*Capreolus Capræa*, Gray, Cat. Osteol. B. M. 64.—*Capreolus Europæus*, Sundev. Pecora, 61.—*Roe Buck*, Penn.—*Chevreuil* and *Chevrette*, Buffon, H. N. vi. 198.

Inhabits Europe. A larger variety is said to have formerly inhabited the Tyrol.

2. Capreolus pygargus. The Ahu.

Interior of the ears fulvous; fur pale yellowish; horns elongate.

Cervus pygargus, Pallas, Reise, i. 97, 198, 433. ii. 159; Spic. xii. 7 (not Hardwicke); Schreb. Saugth. v. t. 253.—*C. capreolus* β, Pallas, Zool. Ross. Asiat. i. 219.—*Cervus Ahu*, Gmelin, Reis. iii. 496. t. 56;

Griffith, A. K. iv. 122. t. .—*Capreolus pygargus,* Sundev. Pecora, 61.—*Tailless Deer,* Pennant, Quad. i. 121.—*Tailless Roe,* Shaw.
Inhabits Central Asia. Collection of the British Museum.

12. Furcifer, part. Wagner, Sundev.; *Mazama,* part. Gray, H. Smith; *Hippocamelus,* Leuckart, 1816; *Cervequus,* Lesson; *Capreolus?* Gray.

Horns erect, forked, without any basal snag; ears narrow, acute; a short tail; covered with thick, brittle, waved hairs; there is a distinct pencil of hairs on the inside of the hock, but none on the outer sides of the metatarsus. Confined to South America. Differs from *Capreolus* in the want of the outer tuft on the leg.

1. Furcifer Antisiensis. The Tarush or Taruga.

Yellow grey; hairs rigid, quilled, brown, with a yellow subterminal ring; edge of muffle and throat white; face with a brown longitudinal streak, and a lyrate band between the eyes; the hoofs rather broad, worn in front.

Cervus Antisiensis, D'Orbigny, Voy. Amer. Merid. t. f. ; Dict. Univ. H. N. iii. 328; Tschudi, Faun. Peru, t. 18; Sundev. Pecora, 60.
Inhabits East coast of S. America; Bolivian Alps.

2. Furcifer Huamel. The Gemul.

Fur dark, closely yellow punctated; inside of the ears white.

Equus bisulcus, Molina, Chili, 520; Fischer, Syn. Mamm. 430.—*Auchenia Huamel,* H. Smith, G. A. K. v. 764.—*Cervus Chilensis,* Gay et Gervais, Ann. Sci. Nat. 1846, 91.—*Cloven-footed Horse,* Shaw, Zool. ii. 441.—*Guemul,* Chilians.—*Gemuel* seu *Huemul,* Vidaure, Chili, iv. 87.—*Camelus equinus,* Triverianus, Mus. Biol. ii. 179.—*Hippocamelus dubius,* Leuckart de Equo bisulco, 24. 1816.—*Cervequus andicus,* Lesson, Nov. Tab. R. A. 173.—*Cervus* (*Capreolus*) *leucotis,* Gray, P. Z. S. 1849, 64. t. 12.—*Capreolus? Huamel,* Gray, Knows. Menag. 66.

Inhabits mountains on East coast of South America. Patagonia.

The female Gemul in the British Museum and in Lord Derby's Museum at Knowsley is considerably larger, and has the legs thicker, than the Siberian *Ahu,* which is much larger than the European Roe Buck.

MM. Gay and Gervais, who have compared the two species, consider them distinct.

13. Blastocerus, Wagner, Sundev.; *Mazama,* sp. H. Smith; *Furcifer,* part. Wagner and Sundevall.

Horns straight, erect, three-branched, without any basal snag; a very short tail, and rather large ears; are covered with very thin soft hair; they have a distinct pencil of hairs on the inside of the hock, but none on the outside of the metatarsus. Confined to Tropical America, east and west coasts.

1. Blastocerus paludosus. The Guazu-puco.

Fulvous; orbit, sides of muzzle, belly and under side of tail white; face-marks and feet blackish.

Cervus paludosus, Desm. Mamm. 443; H. Smith, iv. 134. t. . v. 796; Fischer, Syn. 444, 616; Licht. Darst. t. 17; Sundev. Pecora, 59.—*C. palustris,* Desmoul. Dict. Class. H. N. iii. 379.—*Cervus dichotomus* (*Guatzupucu*), Illiger, Abhand. Akad. d. W. 1804–1811, 117; Pr. Max. Neuw. Isis, 1821, 650. t. 6.—*Blastocercus paludosus,* Gray, Knows. Menag. 68.

Var.? *Mazama furcata,* Gray, Cat. Osteol. B. M. 64.

Inhabits the Brazils.

2. Blastocerus campestris. The Mazame or Guazuti.

Fulvous brown; the hairs of the lower part of the nape and front of the back reversed; the hoofs narrow. Young: middle of back not spotted; sides with small white spots, the upper series forming a regular line.

Mazame, Hernandez, Mex.; Buffon, H. N. xii. 317.—*Veado branco, Veado campo,* Anchieta, Notic. i. 127.—*Cervus bezoarticus,* Linn. S. N. ed. 10. 67.—*C. campestris,* F. Cuvier, Dict. Sci. Nat. vii. 484?; Cuvier, Oss. Foss. iv. 51. t. 3. f. 46, 47.—*C. campestris,* Licht. Darst. t. 19; Pr. Max. Abbild. t. ; Darwin, Zool. Beagle, 29. fig. horns; H. Smith, G. A. K. iv. 136. t. . v. 797.—*C. leucogaster,* Goldfuss, Schreb. Saugth. 1127.—*Mazama campestris,* H. Smith; Gray, Cat. Osteol. B. M. 64.—*Biche de Savanne,* Buffon, Supp. iii. 126.—*Gouazouti,* Azara, Essai, i. 77.—*Furcifer campestris,* Gray, Knows. Menag. 68.

Inhabits S. America; N. Patagonia. Collection of British Museum.

The figure of *C. campestris* in F. Cuvier, Mamm. Lithog., is evidently a *Cariacus,* and not of this genus. The horns from Brazils figured by Cuvier (Oss. Foss. iv. t. 3. f. 48) appear to belong to quite a different species. It may be the variety of the Roebuck, figured in Griffith, A. K. iv. t. 164. f. 6.

14. Cariacus, Gray; *Mazama,* Sundev.; *Mazama,* part. H. Smith.

Horns cylindrical, arched, with a central, internal snag, the tip bent forwards, and with the lower branches on the hinder edge; they are covered with soft thin hair, have a moderate tail furnished with long hair on the under side, a white anal disk, rather elongated, large, rounded ears; they generally have a tuft of white hair on the outer side of the hind-leg, rather below the middle of the metacarpus, but it is sometimes not to be seen; the skull has a very small, shallow, suborbital pit, and the nasal bone is broad and subtriangular behind; the tail is elongate, slender, pale, with the lower part dark, and reaching nearly to the hocks in summer; much shorter and broader, and all dark olive in the winter. Confined to North America.

* *Hoofs narrow, elongate; tail hairy beneath.*

1. Cariacus Virginianus. The American Deer.

Bright fulvous in summer, greyer in winter; tail fulvous above, the tip black, beneath white; carried erect when running; nose brown; side of mouth white, with an oblique black band from the nostrils; hoofs narrow, elongate.

Dama Virginiana, Raii Syn. 86.—*Fallow Deer,* Lawson, Carol. 23;

Catesby, Carol. App. 28.—*Cervus Dama Americanus*, Erxl. Syst. 312. —*Cervus Mexicanus*, Licht. Darstell. t. 20.—*Cervus Strongyloceros*, part, Schreb. Saugth. 1074, not figure.—*Cervus campestris* (*Mazame*), F. Cuv. Mam. Lithog. t. .—*Cervus Virginianus*, Gmelin, S. N. i. 179; Desm. Mamm. 442; F. Cuvier, Mam. Lithog. t. 205.—*C. Mangivorus*, Schrank, Ann. Wetter. i. 327, 1819, from Buffon.—*C.* (*Mazama*) *Virginiana*, Bennett, Gard. Z. S. 205; Fischer, Syn. 449; Peale, U. S. Explor. Exped. 39; Sundeval, Pecora, 58.—*Cervus leucurus, Long-tailed Deer*, Douglas, Zool. Journ. xv. 330; Richardson, Faun. Bor. Amer. i. 258.—*C. Mazama leucurus*, Sundeval, Pecora, 59.—*Cariacus Virginianus, C. leucurus*, and *C. Mexicanus*, Gray, Cat. Osteol. B. M. 63, 64.—*Virginian Deer*, Penn. Syn. 51. t. 9. f. 2; Quad. i. 104. t. 11. f. 1.—*Cerf de La Louisiane*, Cuvier, R. A. i. 256; Oss. Foss. iv. 33. t. 5. f. 1–5.—*Chevreuil*, Charlev. Nouv. Fran. iii. 152.—*Cariacou*, Buffon, H. N. xiii. 347. t. 44.—*Cariacus Virginianus*, Gray, Knows. Menag. 66. t. 46, winter coat.

Inhabits N. America.

Mr. Peale observes,—"We believe that the same species of Deer inhabits all the timbered or partially timbered country between the Coast of the Atlantic and Pacific Oceans. They vary in size, as all the animals of this genus do, in different feeding-grounds, but they are specifically the same." The Mexican Deer (Penn. Syn. 54. t. 9. f. 3, and Quad. i. 20), *Cervus Mexicanus* (Gmelin, S. N. i. 179; H. Smith, G. A. K. v. 729, iv. 130. t. ; Cuvier, Oss. Foss. iv. t. 5. f. 23), *Cervus ramosicornis* (Blainville), are all described from horns, which only appear to be much-developed horns of this species which have belonged to some well-fed animals.

The horns described and figured as *C. clavatus* (H. Smith, G. A. K. iv. 132. t.), appear to be only varieties of the common form.

1. The *Cervus Mexicanus* (Lichten. Darst. t. 20; Sundeval, Pecora, 59),
2. The *Cervus nemoralis* (H. Smith, G. A. K. iv. 157. t. ; Sundeval, Pecora, 59),
3. The *Cervus gymnotis* (Wiegmann, Isis, 1833; Sundeval, Pecora, 59),

all from Mexico, appear to be varieties of this species. *C. Mexicanus* is said to have a brown tail and indistinct chin-band. The nakedness of the ears, which is peculiar to *C. gymnotis*, is often to be observed in these animals when in change of fur. *C. spinosus*, Gay and Gervais, is only known from a single horn from Cayenne.

2. Cariacus Lewisii. The Black-tailed Deer.

The tail black above towards the extremity, yellowish white beneath, covered with hair at all seasons, not carried erect when running; fulvous (in summer); hair very soft, not ringed; forehead and upper part of face before the eyes blackish; inside of the legs and belly white; chin-band distinct, black; front hoofs narrow, elongate. Horns like *C. Virginianus*, but generally more slender, and commonly without the first antler.

Black-tailed Deer, Anglo-American in Oregon.—*Black-tailed Fallow Deer*, Lewis and Clerk, Travels to the Pacific, ii. 26, 125

(London edit. 1807).—*Cervus macrotis β. Colombiana,* Richardson, Fauna Bor. Amer. i. 257.—*Long-tailed Deer* (*Cervus macrourus*), H. Smith, G.A.K. iv. 134, v. 795, part; Fischer, Syn. 615.—*Cervus Lewisii,* J. Peale, U. S. Explor. Exped. 39. t. 9, ined. fig. at p. 43, fore-foot; Gray, Knows. Menag. 67. t. 44, in summer, t. 45, in winter fur.

Inhabits N.W. Coast of N. America.

3. Cariacus punctulatus. The Californian Roe.

Dark reddish brown (in summer), minutely punctulated by the yellow tips of the hair; chin-mark distinct; ears elongated, nakedish; base of the ears, orbits, round the muzzle, under side of tail, and the upper part of the inside of the leg, white; forehead, line down the face, and narrow streak on upper part of the nape black; legs brown; a very narrow, indistinct streak on the middle line of the rump yellowish; tail like back, with a blackish tip.

Inhabits California.

There is a female of this species in the Zoological Gardens. It is much smaller than the Black-tailed Deer, and darker than *C. Virginianus,* and it differs in the hair being dark, with a distinct yellow subterminal band.

** *The front hoof broad cordate; tail not hairy beneath.*

4. Cariacus macrotis. The Mule Deer.

Brownish fulvous; chin without any or only an indistinct band; tail pale ferruginous, with a black tuft at the end, and without any hair beneath; ears very large; hoofs of the fore-feet broad cordate, nearly as broad as long, flattened and concave beneath; horns larger and more spreading than in *C. Virginianus.*

Mule Deer, Anglo-Americans of the Rocky Mountains.—?*Mule* or *Black-tailed Deer,* Le Raye; Lewis and Clerk, Travels; Wied, Voy. Amer. Merid. iii. 273, and Vig. A, B.—*Cervus macrotis,* Say, Long, Exped. Rocky Mount. ii. 88; H. Smith, G. A. K. v. 794; Fischer, Syn. 444, 615; Sundeval, Pecora, 59; Richardson, Faun. Bor. Amer. 254. t. 20; Peale, U. S. Expl. Exped. 41. t. 10 (ined.), fig. at p. 43, fore-feet; Gray, Knows. Menag. 67.—*C. auritus,* Desm. Dict. Class. H. N. iii. 379.

Inhabits N.W. America; Arakansa.

We have several skulls of this genus in the British Museum, which offer very distinct characters, but unfortunately, not having the skins belonging to them, we cannot identify with certainty the species to which they belong.

These skulls vary considerably in width and comparative length of the face, and in the extent and depth of the suborbital pit; in some, which are probably the skulls of the *Black-tailed Deer* as they come from the north-west coast, the pit is very large and deep; and thirdly, in the extent of the intermaxillary lines. In some they scarcely reach to the nasal; in others they reach to it and are united to it by a rather broad suture; and in others they do not nearly reach to it, but stop abruptly, ending in a notch in the front upper edge of the maxillary.

There is imported by the North Western American Fur Company

the flat skin of two Deer which probably belong to this genus, and appear distinct from the preceding: 1. The *Orenoka Deer* (of the Company's list). It came from Central America, is of a large size, of a bright red-brown colour, with the hair of the back short and rather adpressed, the chin and under part of the body white, the tail blackish; 2. The *Yucatan Deer,* about the size of the *American Deer* (*C. Virginianus*), but very distinct from the skin of that species in the same store; the fur is short red brown with blackish tips.

15. Coassus, Gray; *Subulo,* H. Smith, Sundeval.

Horns simple, rudimentary, shelving back; ears rather short, broad, rounded; tail short; the facial line rather convex; the fur short, of the forehead (in both sexes) elongate, forming a rhombic tuft between the horns and face; legs without any tuft on the outside of the metatarsus, but with a pencil on the inside of the hocks. Confined to Tropical or South America.

* *Ears nakedish; skull with a very small, shallow, suborbital pit; supraorbital foramens in a groove.* East coast of America. *Coassus.*

1. Coassus nemorivagus. The Cuguacu-apara.

Pale brown; the hair dull-coloured, brown, with a yellow subterminal band which wears off; a paler streak over the eyes. Young: brown, white spotted; spots of sides unequal; nape dark. Skull elongate, suborbital pit broad, subtrigonal shallow; grinders moderate, infraorbital ridge very distinct, sharp-edged. The intermaxillaries do not reach to the nasal but fit into a notch in the maxilla.

Cervus nemorivagus, F. Cuvier, Dict. Sci. Nat. vii. 485; Cuvier, Oss. Foss. iv. 54. t. 5. f. 50; Fischer, Syn. 446, 618; H. Smith, G. A. K. iv. 142. t. ; Sundev. Pecora, 60; Licht. Darstel. t. 21.—*Coassus nemorivagus,* Gray, Cat. Osteol. B. M. 64; Knows. Menag. 68. t. 48.—*Cervus nemorum,* Desm. Mam. 446.—*C. simplicicornis,* Illiger, Pr. Max. Abbild. t. .—Young? *Moschus delicatula,* Shaw, Mus. Lever. t. 36.

Inhabits Brazils.

A male specimen at Knowsley Menagerie was dark brown; streak on each side of the forehead, upper part of the legs and spot on the angles of the lower lip blackish; streak over each eye yellowish; under lip and spot on upper lip near muffle, underside of the tail and inner side of the upper part of the thighs white; muffle smooth, bluish, upper edge slightly arched; ears small, lower half of the inner side black.

This male was the size of a full-grown Roebuck, as is the largest of the genus in the Menagerie.

There is a female at Knowsley which is probably a young female of this species. Mr. Fraser thus described it: "A female: dark grey, tinged with brown, greyer on the head and neck; the lower part, and the inside of legs, the belly and round the eyes rust-coloured; the purple brown patch in the ears smaller and less distinct than *C. rufus.* A small white stripe in front of the eyes and the under surface of the tail white; from the eyes to the nose short and thick compared with the other specimens."

2. Coassus rufus. The Cuguacu-ete or Pita.

The fur bright shining red; crown and neck grey; sides of face and chest paler. Young: reddish, white spotted, spots of side unequal; nape with a distinct white-edged dark central streak; the muffle carunculated, rather angularly produced above.

Var. With white rings above the hoofs.

Cervus rufus, F. Cuvier, Dict. Sci. Nat. vii. 485; Cuvier, Oss. Foss. iv. 53. t. 3. f. 41, 42, t. 5. f. 44; H. Smith, G. A. K. iv. 140. t. ; Pr. Max. Abbild. t. ; Fischer, Syn. 446, 618; Licht. Darst. t. 20; Sundeval, Pecora, 60.—*Cervus simplicicornis* (*Apara* β.), H. Smith, G. A. K. iv. 141. t. .—*C. dolichurus,* Wagner, Supp. iv. 389.—*Cariacou de la Guyane,* Buffon, ix. 90.—*Biche rouge,* Buffon, Supp. iii. 126.—*Gouazou pita,* Azara.—*Coassus rufus,* Gray, Knows. Men. 69. t. 47.

Inhabits S. America.

The males cast their horns in the month of September, and they are very shortly replaced by a new pair.

Mr. Fraser has kindly sent me the following description of the female at Knowsley:—"A female: light red brown, neck and head greyer; darker grey on the hocks and upper part of the fore legs; the forehead with one black stripe on each side a grey one in the centre, which leaves two brown yellow stripes on each side; ears with a purplish brown patch of about a third of the whole extent inside; the muffle is carunculated, of a purplish hue."

3. Coassus superciliaris. The Eyebrowed Brocket.

Bright shining red; neck and head grey; forehead darker; hocks and front of the fore legs grey; stripe in front of the eye and undersurface of the tail white; muffle deeply arched above; ears moderate.

Coassus superciliaris, Gray, Gleanings Knows. Menag. t. 48.

Inhabits the Brazils. Para.

This species chiefly differs from the former in the form of the muffle and in the presence of the white streak over the eyes. There is a male at Knowsley, and formerly there was a female in the Gardens of the Society.

4. Coassus auritus. Large-eared Brocket.

Bright pale red brown; head and neck grey; orbits pale brownish; spot on side of upper lip, chin, belly, hinder side of fore and front side of hinder thighs and under side of tail, white; crown dark grey brown; ears very large, broad, acute, more than half the length of the head, with two lines of hairs in them.

Inhabits the Brazils.

There is a female of this species in the Gardens of the Society; it greatly resembles the Indian *Muntjac* in the distribution of its colour.

In the British Museum there are two skulls which belong to these species. They have the face shorter and thicker than the skull of *C. nemorivagus,* the nasals are wider behind; the suborbital pit small or less impressed, and the grinder larger.

The first belongs to a young specimen in the Museum Collection, apparently of *C. rufus.* It has a small slightly impressed pit just in

front of the edge of the orbit. The second belongs to a more adult female, sent, without the skin, from Para by Mr. Reginald Graham; it is considerably larger than the preceding, and there is scarcely any visible impression in front of the orbit, only a slight concavity of the general surface. This skull exactly resembles that of *C. superciliaris*, which was in the Zoological Society's Gardens.

** *Ears thickly covered with short hairs; skull with a very deep oblong suborbital pit; face short; grinders large.* West coast of America. *Pudu.*

5. Coassus Pudu. The Venada.

Fur rufous, blackish in front and darker behind, and on the forehead and lower part of the leg; hairs ringed, of cheeks and neck greyish, of forehead and ears bright rufous; ears short; tail very short.

Cervus humilis, Bennett, P. Z. S. 1831, 27. fem.; Sundev. Pecora, 60.—*C. rufus*, Wagner, Supp. iv.—*Capra Pudu*, Molina.—*Chevreuil*, Poeppig, Froriep's Notiz. 1829; Férussac, Bull. Sci. xix. 95.—*Cervus Pudu*, Gervais, Ann. Sci. Nat. 1846, 90.—*Antilope (Mazama) Temmamazama*, H. Smith, G. A. K. iv. 291?

Inhabits Chili; Conception and Chiloe (*King*). Brit. Museum.

CORK CUVIERIAN SOCIETY.

April 7, 1852.—C. B. Newenham, Esq., presented to the Society a slab exhibiting fossil casts of foot-steps.

Dr. Haines wished to direct particular attention to the flag now laid on the table by Mr. Newenham, first, in order that due merit might be rendered to the discoverer, and in the second place, to indicate the character, great interest, and importance of the discovery. Mr. Newenham's attention was drawn to this flag, lately laid down on one of our pathways, when walking over it in a shower of rain, which rendered the track more visible. All persons present may not be aware of the value of data which carry us back, step by step, to the knowledge of the primæval states of animal life on the earth. This is, Dr. Haines said, he believed, the first observation of the foot-prints of the higher classes of animals made in Ireland. The first discovery of foot-marks was that of reptiles in the lower part of the New Red Sandstone in Scotland; then they became known as common in the New Red Sandstone of England and the continent, and in a part of the same formation the foot-marks of birds were found in America. Here we now have, the occurrence of foot-prints in a rock of greater age, in this slab of millstone-grit from Kilrush, county of Clare, from whence the flagging-material of our streets is obtained. Dr. Haines went on to state, that some years since he had exhibited to this Society and to the British Association some very beautiful and new fossil casts referable to Annelids from this same rock, and pointed out some traces which might possibly be the foot-markings of a crustaceous animal. Since then those flags have presented us with numerous fossil impressions, but until now, none referable to the track of an animal of a high order. On this flag there are seven pair of de-

cided foot-impressions, evidently the track of one animal; they are very regular, about $4\frac{1}{2}$ inches in advance of each other, and over 3 inches apart laterally. Two or three of these feet show three toes in front and one strong linear impression pointing directly backwards, which caused some persons to think them at first the marks of a bird; but they are not the walk of a biped, as a bird, with alternate steps; and therefore it was said the bird was in the act of jumping forwards, bringing both feet to the ground at once and nearly in a line. He, Dr. Haines, thought them the track of a quadruped, that is, a four-footed creature, and probably a reptile; but it was not easy to reconcile the markings to any known mode of progression, and therefore he made a *second examination*, when he *discovered* that there are the impressions of another pair of feet between each of the former, which satisfies every difficulty and proves the creature to have been quadrupedal. Those additional foot-prints, which Dr. Haines has just discovered, are comparatively indistinct, so much so as to have been at first entirely passed over by every one looking at the stone; but now, on being pointed out, they are equally convincing, when taken in relation with the other marks, to all who examine them.

The condition of the slab now is, that we have twenty-six impressions instead of fourteen; fourteen large, about 1 inch in length each, and half an inch wide; twelve smaller casts, nearly half an inch long, giving the idea of the impression of one central toe only. These smaller marks incline inwards towards each other, and also lie an inch and a half in advance, and a little within the line of the larger feet. In the original mould the *right* feet, both small and large, are constantly slightly in front of the line of advance of the feet of the left side. The distance of the large impressions before the smaller ones by the progress of the animal is about $2\frac{1}{2}$ inches.

It seems clear then that this four-footed creature had two smaller fore-feet and two larger hind-feet; that in the alternate bringing up of the feet as it walked, the hind-foot approached the fore-foot perhaps pretty closely, as we must make allowance for those portions of the feet not fully impressed in the mould. It would be quite possible to calculate the length of the body and length of limbs from the data of these foot-tracks; and from the high relief of the casts of the hinder feet and their width apart, the body must have been wide and heavy, in relation to its other dimensions. To convey a short sketch of foot-prints, Dr. Haines stated that about twenty-six years since was the date of their earliest notice; first in the New Red Sandstone, as already mentioned; then in older rocks which are called the Coal-measures, in Bavaria, in America, and *now in Ireland*, for the Millstone-grit is of the lowest part of that series; since then they have been discovered so low down and remote in age as the Upper Devonian sandstones in Morayshire; and still more remote in time, in a sandstone at the base of the Silurian rocks in Canada*; thus proving an antiquity for the vertebrated division of animals as far back as almost the first traces of created being.

* With regard to the Canadian foot-tracks, these have been referred by Professor Owen, in a paper lately read before the Geological Society, to Crustaceans.—Ed.

MISCELLANEOUS.

TWIN MUSHROOM.

Mr. Anderson, gardener to the Earl of Stair at Oxenford Castle, exhibited at the last Meeting of the Edinburgh Botanical Society a singular twin mushroom, represented in Pl. XVI. C. It would appear as if two mushrooms had united together by the summit of their pileus in the young state, and that one had afterwards grown so vigorously as to detach the other from the soil, and bear it on the tip of its pileus inverted. The substance of the pileus of the two mushrooms is intimately united, as seen in fig. 2. In the lower mushroom the lamellæ are as usual in the lower surface, while in the upper surface the pileus being inverted the lamellæ appear above.

Fig. 1. shows the two mushrooms united, with the lamellæ on both sides.
Fig. 2. shows a section through the two mushrooms.

On the Circulation of the Blood in Insects. By M. Léon Dufour.

I shall not refer to all the proofs which I have accumulated to show that the tracheary apparatus of insects is solely an organ of respiration, a vascular system intended exclusively for the circulation of air. This subtle fluid penetrates, by an infinity of ramifications, into all the tissues, to communicate to them the benefits of respiration, to give the blood with which they are imbued that vivification, that nutritive faculty, in search of which, in the higher animals, the vessels come to a circumscribed respiratory organ, either lungs or gills. I only wish, at present, to discuss the new facts lately brought before the Academy in support of the theory of peritrachean circulation.

That silkworms which have been fed on leaves powdered with blue or rose-colour, produce blue or rose-coloured cocoons, is an incontestable fact. Neither do I deny the coloration of the tracheæ observed by MM. Alessandrini and Bassi. But, whilst admitting these facts, since proved by M. Blanchard, I am far from coinciding with him in the consequences which he has deduced from them. The blue blood, we are told, fills the abdominal cavities, the *lacunæ*, penetrates the dorsal vessel, and nevertheless neither the muscles nor the viscera are coloured ; they preserve their usual whiteness ! What ! those powerful locomotive muscles, into which, even with the naked eyes, we see tracheæ of such large size penetrate, to perform the important functions of reparation and nutrition, receive no tinge from that blue blood, which, even according to the hypothesis of peritrachean respiration, must insinuate itself everywhere ! And those digestive viscera, so rich in tracheæ of all dimensions, the detection of which does not require a microscope or even a simple lens—those ventricular parietes, through which, even according to this author, the blue nutritive fluid transudes—these viscera remain white ! And those serific glands, which in the exercise of their secreting faculty can admit the blue colour (for this is transmitted to these cocoons)—these glands offer no appearance of blue !

Because the tracheæ appear blue, is it necessary to conclude that this can only be caused by the imprisonment of blue blood between an external membrane and the true coat of the aëriferous duct of

the trachea? If the thoraco-abdominal cavity be filled by a blue nutritive fluid, why should not the walls of the tracheæ, which, like all the tissues of the organism, require nutrition and reparation, be also penetrated by these blue particles? Is it necessary, in order to explain this coloration, to recur to an intermembranular cavity, the existence of which I think I have sufficiently disproved by facts and arguments?

Perhaps, in regard to the absence of coloration in the ramifications of the tracheæ, M. Blanchard will intrench himself behind these words in his communication—"The tracheæ present the deepest tint at their base, becoming gradually paler to the extremity." This argument may appear valid if we only regard one of these canals separately; but, as every one knows, the isolated filaments of a blue cocoon do not appear blue, although the whole of the filaments produce a blue cocoon,—and the same effect must take place in the living tissues of an insect, when the blood-vessels, however capillary they may be, become pressed together in close ramifications for the performance of their nutritive functions.—*Comptes Rendus*, Nov. 17, 1851.

On the Transmigration of Worms. By CHARLES VOGT.

The worms, those Pariahs of the animal kingdom, have long been neglected by zoologists; the intestinal worms in particular, from the uncertainty which existed as to their organization and development, have been united into an ill-defined group. It is nevertheless amongst these animals that modern zoology has discovered some of the most remarkable facts in the history of the animal organism and embryogeny.

The theory of spontaneous generation, attacked and overturned on all sides, has long sought a last refuge in the history of the intestinal worms. How has it been possible for an animal, a parasitic worm, deprived of sexual organs, to appear and propagate in the closed cavities of the bodies of man or animals? Such is the embarrassing question put by the partisan of the "*generatio æquivoca.*" If we dissect one of our little freshwater fishes, the stickleback (*Gasterosteus aculeatus*), we shall find in the cavity of its body a worm belonging to the genus *Bothriocephalus,* which is entirely destitute of generative organs. If we confine ourselves to this single fact, the formation and reproduction of this parasite are no doubt difficult to explain, and one is easily tempted to call in the aid of the *Deus ex machinâ* of spontaneous generation. But a second observation shows us, that at the moment when the fish in question becomes the prey of some aquatic bird, its worm passes into the body of its destroyer, where it receives its true development,—for it is then only that its segments become filled with eggs, which, rejected with the excrements of the bird, fall into the water and thus pass into the bodies of the fishes which swallow these excrements. Without pretending to explain the history of all the parasitic worms as naturally as this, we present the following facts as a new argument against their pretended spontaneous generation.

All worms possess generative organs, provided they find the conditions necessary for their development. It is true that we find in worms, Crustacea, Insects, &c., parasites, called *Gregarinæ,* totally

destitute of internal organs, but the embryogenic development of these organisms is still too little known to permit us to arrive at any certain conclusion.

The division of *Nematelmia* includes among its members a worm with an elongated, cylindrical body, resembling a brown horse-hair. Its coriaceous skin readily absorbs the liquid which surrounds it. When dried, its body becomes as brittle as a horny thread. This worm, known by the name of *Gordius*, inhabits the water of springs, ditches, &c. When taken from the water, it retains its life for a certain time, and on being restored to that element resumes its usual movements. This property is very useful to it during a certain period of its life. The *Gordius* does not, as was long supposed, inhabit water only, but passes the first portion of its life as a parasite in the bodies of various insects, and especially in the abdominal cavity of grasshoppers, where this worm, so large when compared with its habitation, may be found rolled up into a ball. When its sexual organs are developed, it quits its first habitation to finish its career in some piece of water, or in the basin of some rustic spring, where it deposits its eggs in long chains.

We are still ignorant of the first stage in the development of the *Ascarides*, which are very common in the human intestines. It is known, however, that as soon as their eggs are mature, these worms quit their ordinary habitation and sometimes even perforate the intestinal canal. Some observations made on a parasite of the frog, serve not only to throw some light on the development of the *Ascarides*, but also on the presence of worms in the closed cavities of the bodies of animals. Certain Nematoid worms deposit their young in the blood-vessels of frogs. These little parasites, which are true larvæ, circulate during a certain time with the blood, until, having arrived at the proper period of their development, they pierce the walls of the capillary vessels. After secreting a capsule, which at first is colourless, but afterwards becomes brown, the worm rolls itself up spirally within it. When transparent portions of the mesentery of a frog are examined under the microscope, these little capsules may frequently be seen, always arranged along the course of the blood-vessels. The worm in this pupa state does not possess generative organs; these are not developed until after it has left the capsule. Sometimes the young worm, not finding the conditions necessary for its further development, dies while still in the capsule, which then becomes incrusted with calcareous matter, and remains in the midst of the animal tissues in the form of a small stony concretion. A great number of individuals of a worm of this group (*Trichina spiralis*), which presents these calcareous incrustations, has recently been discovered in the muscles of the human body.

Every one knows the *Tænia*, or tapeworm, which frequently attains an enormous length in the human intestines. Every one of its numerous segments is filled with ovaries and testicles. At the period when the eggs contained in the ovaries become mature, some of the segments, either separated or attached to one another, become detached and pass from the body with the excrements. It is not yet known how the young tapeworms, thus dispersed, arrive in situations favourable to their development, nevertheless the repartition of the

Tænia and *Bothriocephalus* will throw some light on this point. The latter worm only occurs in Switzerland, Poland and Holland, whilst the *Tænia* inhabits the intestines of the French and Germans. When individuals belonging to these two nations live for a certain time in Switzerland, they sometimes get the *Bothriocephalus*, but never the *Tænia*. In all the countries in which the *Bothriocephalus* is so frequent, it is customary to water the plants used as food with the liquid excrement procured from the cesspools. There is no doubt that some of the eggs of the *Bothriocephalus* ejected with the excrements find their way, with salads and other raw vegetables, into the human intestines. These eggs contain a little embryo, which exhibits very lively movements of contraction and dilatation; the anterior portion of its body is furnished with six retractile hooks. In the pulmonary cavity of the common slug, some little, milk-white cysts of $\frac{1}{150}$ inch in diameter frequently occur; each of these contains a young *Tænia*. It is very probable that as soon as the slug has been devoured by some other animal, the worm quits its envelope and developes new segments. The animals of the genera *Scolex* and *Tetrarhynchus*, which are so often met with in the intestines of marine fishes, are only the young cephalic segments of *Tæniæ*, which afterwards fix themselves, after losing the trunks armed with hooks, which are useful to them during their migrations in the bodies of fishes.

Occasionally the *Tænia* loses itself during its peregrinations; its metamorphoses then become arrested, and certain portions of its body undergo morbid transformations; hydatids are nothing but abortive *Tænias*, of which the normal development sometimes depends upon mere chance. The liver of rats and mice often contains an elongated worm, the last segment of which is transformed into a bladder filled with water; but as soon as this passes into the intestines of a cat, the terminal vesicle of the parasite disappears, it developes new segments, and becomes a true *Tænia*, long since described by naturalists.

If during the summer some *Lymnææ* or *Paludinæ*, of which the shells have been removed, be held in pure water and their skins slightly torn, numbers of microscopic worms will be seen to issue from them, appearing in the water like whitish clouds. These creatures, whose body is terminated by a tail, have often been classed amongst the Infusoria under the name of *Cercaria*. The *Monostomum mutabile*, which inhabits the aëriferous cells of aquatic birds, produces embryos which swim quickly, and within which a second embryo may be seen moving; the latter completely resembles the worms which are found in the *Lymnææ*, in which the *Cercariæ* are formed. The primitive embryos of the *Monostomum* probably leave the aëriferous vessels of the birds when the latter are in the water, and afterwards penetrate into the mollusks. Here the *Cercariæ* are formed by gemmation, and they have been seen to penetrate into the larvæ of aquatic insects by the aid of the corneous points which they bear on their heads. During this passage they lose their caudal appendage, and then exhibit the form of the Trematode worms. After this they become contracted, and surround themselves with an envelope as transparent as glass, within which they await their further development, which only takes place according as the insects undergo their metamor-

phosis, or become the prey of birds, fishes, frogs, &c. Other *Cercariæ* pass directly from the body of the mollusk into that of the bird, &c. These metamorphoses, taking place consequently in the bodies of animals belonging to the principal types of the animal kingdom, furnish the most evident proof against the old opinion, that the parasitic worm could only exist within the animal for which it was formed. On the contrary, the preceding facts appear to prove to us, that the migrations of worms through various organisms are a necessary condition of their normal development. Classification will necessarily be much affected by these observations. Many species and genera will be suppressed. Thus it has been discovered quite recently, that a worm belonging to the family of *Polystomata*, the genus *Gyriodactylus*, which is found on the branchiæ of many freshwater fishes, is only a transitory form which propagates by gemmation. In the interior of this worm, which possesses all the organs of the adult *Trematoda*, a young one is developed by gemmation, which nearly attains the size of its mother, and finally passes out by an opening on the abdominal side of the latter. Whilst it still remains within the body of its mother, it forms, by gemmation, a second young one within its own body; so that in these worms, the mother frequently contains at once her daughter and grand-daughter.—*Bibl. Univ. de Genève*, December 1851, p. 347.

METEOROLOGICAL OBSERVATIONS FOR MARCH 1852.

Chiswick.—March 1. Fine. 2. Overcast: fine: clear, with sharp frost. 3. Clear and frosty: fine: sharp frost at night. 4. Very fine: clear: severe frost at night. 5. Frosty: bright sun: frosty. 6. Slight haze: clear. 7. Frosty, with haze: fine: slight haze. 8. Uniform haze: overcast. 9. Cold dry haze: fine: clear. 10. Hazy: foggy at night. 11. Hazy: densely overcast. 12. Cloudy: clear. 13. Flying haze: cold and dry. 14. Uniformly overcast. 15. Foggy: dusky haze. 16. Slight drizzle: cloudy. 17, 18. Cloudy and cold. 19. Cold haze: white clouds: clear and frosty. 20. Clear and fine: frosty. 21, 22. Fine. 23. Slight haze: fine: clear: frosty. 24. Overcast: densely clouded. 25. Clear: overcast. 26. Clear: cloudy: frosty. 27. Frosty: cloudy: clear. 28. Overcast. 29. Hazy: fine: rain. 30. Rain: cloudy and mild: overcast. 31. Uniform haze: overcast and cold: cloudy.

Mean temperature of the month	36°·92
Mean temperature of March 1851	41 ·72
Mean temperature of March for the last twenty-six years ...	42 ·52
Average amount of rain in March	1·40 inch.

Boston.—March 1. Fine. 2. Cloudy. 3. Fine: snow A.M. and P.M. 4—7. Fine. 8, 9. Cloudy. 10. Foggy.. 11. Cloudy. 12. Fine. 13. Cloudy. 14. Cloudy: rain A.M. 15. Cloudy: rain P.M. 16, 17. Cloudy. 18. Fine. 19. Cloudy. 20—26. Fine. 27, 28. Cloudy. 29. Fine. 30. Cloudy: rain early A.M. and P.M. 31. Cloudy.

Sandwick Manse, Orkney.—March 1. Snow-showers. 2. Snow-showers: snow. 3. Snow: fine. 4. Snow: fine: light halo. 5. Thaw: clear: fine. 6. Fine: clear: fine. 7. Fine: hazy. 8. Fog: fine: fog. 9. Fog. 10—15. Hazy: fine. 16. Drops: hazy: fine. 17. Hazy: fine: cloudy: fine. 18. Bright: fine: cloudy: fine. 19—21. Bright: fine: clear: cloudy: aurora. 22. Cloudy: fine. 23. Fog: cloudy. 24. Bright: cloudy. 25. Hail-showers. 26. Hail-showers: snow-showers. 27. Snow-showers. 28. Snow: bright: snow: clear. 29. Cloudy: snow-showers. 30. Bright: clear. 31. Cloudy.—This month has been remarkably fine and dry, with a high barometer and thermometer. The average quantity of rain in March for six previous years was 2·55, and in one month only was the quantity smaller, viz. Sept. 1846, when it was only ·60. The average temperature of March for twenty-six previous years 40°·38. The average state of the barometer has not been higher since May 1844, when it was 30·213.

Meteorological Observations made by Mr. Thompson *at the Garden of the Horticultural Society at* Chiswick, *near London;* *by* Mr. Veall, *at* Boston; *and by the* Rev. C. Clouston, *at Sandwick Manse,* Orkney.

Days of Month.	Barometer.					Thermometer.					Wind.			Rain.		
	Chiswick.		Boston. $8\frac{3}{4}$ a.m.	Orkney, Sandwick.		Chiswick.		Boston. $8\frac{3}{4}$ a.m.	Orkney, Sandwick.		Chiswick. 1 p.m.	Boston.	Orkney, Sandwick.	Chiswick.	Boston.	Orkney, Sandwick.
1852. March.	Max.	Min.		$9\frac{1}{4}$ a.m.	$8\frac{1}{2}$ p.m.	Max.	Min.		$9\frac{1}{4}$ a.m.	$8\frac{1}{2}$ p.m.						
1.	29·803	29·710	29·39	29·57	29·70	49	34	37	37	31	w.	wnw.	ne.	·05	....	·15
2.	29·850	29·749	29·47	29·87	29·98	49	19	32	35	34	ne.	n.	n.	....	....	·14
3.	30·203	29·957	29·64	30·08	30·08	45	19	29·5	32	31	ne.	ne.	s.	....	....	....
4.	30·538	30·312	30·02	30·11	30·14	46	15	28	37	37	ne.	s.	sse.	....	....	....
○ 5.	30·739	30·648	30·30	30·15	30·52	45	19	27	45	44	se.	s.	s.	....	·02	....
6.	30·739	30·699	30·42	30·53	30·60	46	25	31	49	47	ne.	e.	w.	....	....	·03
7.	30·665	30·579	30·32	30·67	30·69	50	28	30	48	47	ne.	e.	sw.	....	....	....
8.	30·543	30·459	30·25	30·64	30·55	49	31	39	45	42	ne.	ene.	se.	....	....	....
9.	30·446	30·386	30·13	30·48	30·47	52	30	37·5	$42\frac{1}{2}$	42	ne.	e.	e.	....	....	....
10.	30·382	30·300	30·05	30·44	30·42	46	26	34·5	44	42	e.	ne.	calm	·01	....	....
11.	30·240	30·217	29·92	30·37	30·38	45	34	40	45	$42\frac{1}{2}$	ne.	nw.	calm	....	....	....
☾ 12.	30·382	30·316	30·00	30·40	30·43	49	25	39	43	43	ne.	nne.	calm	....	....	....
13.	30·428	30·371	30·05	30·47	30·51	48	26	40	45	44	e.	nnw.	wsw.	....	....	....
14.	30·422	30·417	30·07	30·48	30·48	48	25	38	$47\frac{1}{2}$	46	ne.	ne.	w.	....	....	....
15.	30·427	30·415	30·10	30·42	30·44	46	32	41	$46\frac{1}{2}$	46	ne.	e.	w.	....	·03	....
16.	30·402	30·348	30·04	30·40	30·36	48	35	44	45	44	ne.	n.	w.	·01	·01	....
17.	30·333	30·299	29·98	30·28	30·26	48	31	43	45	45	ne.	n.	w.	....	....	....
18.	30·262	30·182	29·90	30·26	30·24	44	31	35	47	43	ne.	n.	calm	....	....	....
19.	30·156	30·106	29·85	30·18	30·06	47	27	43	45	$41\frac{1}{2}$	e.	e.	sse.	....	....	....
● 20.	30·142	30·103	29·78	29·95	29·90	56	25	38	$41\frac{1}{2}$	42	se.	ese.	sse.	....	....	....
21.	30·191	30·107	29·80	29·86	29·87	63	27	38	48	44	se.	se.	e.	....	....	....
22.	30·120	30·108	29·79	29·91	29·92	66	28	43	$49\frac{1}{2}$	46	se.	s.	calm	....	....	....
23.	30·073	29·959	29·67	29·97	30·07	64	25	46	$51\frac{1}{2}$	43	ne.	sw.	ne.	....	....	....
24.	29·887	29·861	29·53	30·13	30·18	66	26	46	40	37	e.	ne.	n.	....	....	....
25.	30·094	29·941	29·68	30·13	30·07	48	35	38	38	37	ne.	n.	n.	....	....	....
26.	29·867	29·766	29·56	29·90	29·78	48	21	36·5	43	$34\frac{1}{2}$	ne.	n.	ne.	....	....	·14
27.	29·663	29·616	29·33	29·65	29·60	46	22	37·5	34	35	w.	w.	calm	....	....	·15
☽ 28.	29·632	29·615	29·40	29·63	29·67	50	38	36	43	35	ne.	e.	calm	....	....	·11
29.	29·533	29·271	29·30	29·64	29·64	58	45	41	42	$36\frac{1}{2}$	e.	e.	e.	·16	....	·01
30.	29·378	29·200	28·85	29·60	29·66	56	45	51	42	38	sw.	s.	ne.	·02	·33	·05
31.	29·852	29·500	29·20	29·82	30·00	48	39	45·5	$44\frac{1}{2}$	41	ne.	n.	ne.	....	·11	....
Mean	30·174	30·081	29·80	30·128	30·150	50·61	28·61	38·2	43·23	40·67				0·25	0·50	0·78

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XXXVI.—*On the Reproduction of the Higher Cryptogamia and the Phanerogamia.* By Arthur Henfrey, F.L.S. &c.

[With a Plate.]

In a report which I furnished to the British Association at the last Meeting (1851), I gave an account of the historical development of the question of the reproduction of the higher Cryptogams, confining myself to a summary of the different views entertained by the various authors who have recently written on this subject.

That report was not accompanied by illustrations; moreover, since it was written I have had more leisure to investigate certain points myself, and to weigh the general conclusions to be deduced from them. Since the new lights which have been thrown upon this subject must entirely change our views of the relations of those higher Cryptogams among themselves and to the flowering plants, and since, moreover, they furnish a basis for a more satisfactory classification of them than we have hitherto possessed, I have thought it might be acceptable to the readers of the 'Annals' if I laid before them an account of what is known respecting the Cryptogams, without the detailed reference to authorities given in the British Association Report, together with a statement of the remarkable points suggested by Hofmeister in reference to the relations of the Coniferæ to the Cryptogamia on the one hand and the Angiospermous flowering plants on the other.

Hepaticæ.

It is well known that the appearance of the spore-fruits or capsules of the Hepaticæ is preceded by that of certain minute organs termed the *pistillidia,* or as they are now more generally

termed the *archegonia*, and the *antheridia*; from the former of which the spore-fruit takes its origin, while the antheridia, after discharging moving spiral filaments or *spermatozoids*, die away and disappear. It has long been supposed that these organs represented the sexual organs of the flowering plants, and that an impregnation of the *archegonia* was effected by means of the *spermatozoids* of the *antheridia*.

These *antheridia* and *archegonia* are produced in various situations; in the frondose Hepaticæ, such as *Anthoceros*, *Riccia*, &c., the *antheridia* and *archegonia* are developed in the cellular substance of the frond; in the leafy *Jungermanniæ* they are found in the axils of the leaves or at the apex of the stem; but under all circumstances they exhibit a structure having a common type.

The *antheridia*, whether they originate in excavations of the cellular frond, as in *Anthoceros*, or as axillary products, present themselves at first as cellular papillæ which grow out, and by multiplication of their cells are converted into stalked clavate or finally almost globular bodies; during this growth the internal cells have undergone a peculiar development and become detached from the outer layer, so that this last appears as a simple cellular membranous coat inclosing a cavity filled with free cellules. At a certain epoch this stalked cellular sac, the perfect *antheridium*, becomes ruptured above, and the contained cellules emerge; in the interior of each of these is seen a spiral filament coiled up, which soon breaks out of the cellule and exhibits active rotatory motion; these spiral filaments are the so-called *spermatozoids*. In some Hepaticæ the *antheridium* is said to have a double cellular coat.

The *archegonia* or *pistillidia* present greater differences. In *Anthoceros* a single row, composed of four or five cells running down from the surface of the frond form the *archegonium*; the lowermost of these produces a free cell in its interior, and then the cross septa of all above it are absorbed, so that an open canal is formed leading down to the free cell at the bottom; it is at this period the impregnation is supposed to take place by a *spermatozoid* penetrating into this canal and coming in contact with the free cellule at the base of the *archegonium*, which then becomes developed into the known pod-shaped capsule of *Anthoceros*.

In *Pellia epiphylla* the *archegonium* grows out from the under side of the edge of the frond as a flask-shaped cellular body, having a cellule (nucleus) within its cavity, which cellule, after impregnation, becomes developed into the sporiferous capsule.

In the leafy Jungermanniæ the *archegonia* are similar flask-shaped bodies, as also are those produced in *Marchantia*, &c.; the involucres which surround them are usually of later origin than

the *archegonia* themselves. In *Riccia* the *antheridia* and *archegonia* originate very early, and the parenchyma of the frond grows up around them as they advance in development; in the case of the *antheridium* its walls become adherent to the enveloping cells; the *archegonium* remains free, and the apex of the neck hangs out from the surface of the enlarged frond.

Hofmeister states that he has several times seen *spermatozoids* swimming about around the *archegonia* in longitudinal sections of the involucres containing the *archegonia* of *Jungermannia bicuspidata* and *J. divaricata*, when these were brought quickly under the microscope (Pl. XVII. A. fig. 1). Moreover in these species, and also in *J. bicrenata* and *scalaris*, he found at the mouths of *archegonia* which exhibited the first trace of the commencement of the development of the fruit, more or less curled, colourless filaments, which resembled the *spermatozoids* of each species in size and aspect, but were motionless.

Musci.

The *antheridia* and *archegonia* of the Mosses essentially resemble those of the Hepaticæ, exhibiting a germ-cell as a *free cell* produced in the base of the *archegonium* (or *pistillidium*) by free cell-formation. The evidence of impregnation is altogether circumstantial as yet, but the existing facts and the analogies with other families render it in the highest degree probable.

In this family, as also in the Hepaticæ, we have in the conditions of the reproductive system a most remarkable set of phænomena, which, until the facts presently to be noticed were discovered, seemed to have a close relation with those in the flowering plants. The spores produce the leafy plant which bears *antheridia* and *pistillidia*, apparently the analogues of the stamens and pistils of flowers; but if we look a little more closely, we see that the *archegonia* differ greatly from pistils (or ovaries), since they do not contain ovules to be fertilized; but a single cell in their interior becomes developed into a complete fruit, often borne upon a stalk, and in the Mosses of very complex structure, which gives origin to a great number of new bodies, the spores reproducing the leafy form. Thus, the *pistillidium*, or as it is better called, the *archegonium*, seems to bear a closer analogy to the ovule than an ovary, and its free central cell to represent the embryonal vesicle of the flowering plants. Thus Hofmeister, to whom we owe most important researches on these subjects, compares the cycle of development in Mosses and Hepaticæ to the "alternation of generations" in the animal kingdom, and he considers the spore-fruit or capsule a distinct body, *related only by descent to the leafy stem*, being in fact the next generation of the plant. A third generation is met with in the leafy-stemmed

Mosses and Jungermanniæ, for their spores are developed into ramified Confervoid structures, each capable of giving origin to a number of buds producing distinct leafy stems. Therefore as the leafy stems are also capable of increasing by gemmæ, we have a process of multiplication occurring in all these generations which collectively represent the cycle of life of a Moss or Jungermannia.

Filices.

Organs which might be considered as representatives of the *antheridia* in Ferns were long sought in vain, till Nägeli discovered peculiar cellular structures in the germinating fronds which produce moving spiral filaments or *spermatozoids*. This discovery rendered the subject only more enigmatical, until Count Suminski brought to light certain other most important facts in reference to these and other bodies unknown to Nägeli, the result of which has been a complete revolution in our ideas of the import of the various reproductive structures of the higher Cryptogamia. Suminski pointed out the inaccuracy of Nägeli's observations on the *antheridia*, and demonstrated the existence of *archegonia*, but he has been followed by several others, who, mostly agreeing among themselves, have given an account of the course of development of the organs, differing in many respects from that furnished by him.

The *antheridia* and *archegonia* of the Ferns are both found upon the little Marchantia-like body (*prothallium*) developed from the spore in its germination. The former are described somewhat differently by different authors; occur abundantly on the under surface of the *prothallium*, and according to some consist of simple globular cells projecting from a cell of the *prothallium*; according to others, of a cellular papilla having a central cavity: the latter seems to be the correct view. In this cavity are produced a number of free cellules which are discharged by its rupture at the apex, and these themselves severally burst and give exit to a ciliated spiral filament (*spermatozoid*) which swims actively, advancing with a rotatory motion through the water under the microscope (Pl. XVII. B. fig. 3, 4).

The *archegonia* (Pl. XVII. B. fig. 1) are less numerous and consist of cellular papillæ considerably larger than the *antheridia*, with a central canal leading down to a large globular cell imbedded in the substance of the *prothallium*; this canal is certainly closed at first and open afterwards, like the canal of the *archegonia* of Mosses, which it essentially resembles. At the bottom of the canal, in the globular cell, is produced a free cell as in the *archegonia* of the Mosses, and it is supposed by most writers that one or more *spermatozoids* pass down the canal to

impregnate this; while Suminski asserts that the end of a *spermatozoid* becomes developed into the embryo here, just as Schleiden asserts the hollow tube to form the embryo in Phanerogamia. After a time this cell begins to divide, and it is gradually converted into an embryo (Pl. XVII. B. fig. 2) with a bud above and a radicle below, from which grows up the regular leafy stem of the Fern*.

The *prothallium* often goes on growing for a long period in a barren condition, even becoming multiplied by throwing off portions which grow out as lobes from its margins; *antheridia* generally present themselves in these. The *archegonia* are rarer, and as a general rule only one of these becomes developed into a stem on each *prothallium*. The *fact* of impregnation rests solely on the evidence of Suminski and Mercklin, the latter of whom states that it is so difficult to observe, that he only met with spermatozoids in the canal of the *archegonium* three times in the course cf a twelvemonth's investigation of the subject.

In this family we find a more complete exemplification of the "alternation of generations," for the spore produces a thalloid generation (the *prothallium*) on which the sexual organs are developed, then the *archegonium* or *ovule* gives origin to the fully-formed plant composed of stem, leaves, and roots, multiplying by a totally different process, namely the development of spores consisting of simple cells. The sporiferous plant is here of indefinitely long life, as, for example, in the Tree-ferns;—the *prothallium* on the contrary, unless it remains sterile, is of very short duration†.

EQUISETACEÆ.

This family has been shown by Thuret, Hofmeister, and others to resemble the Ferns in its mode of reproduction. Its spores produce in like manner a *prothallium*, which however is more lobed and ramified, and of much longer duration than that of the Ferns; upon this are developed *antheridia* and *archegonia*, from the latter of which arises the bud, which gives origin to the new perfect spore-bearing *Equisetum* plant. The *Equiseta* thus stand very close to the Ferns, the one family exhibiting the proponderating development of the leaf, the other of stem in the ultimate, spore-bearing form or second generation of the cycle.

* I have followed out the greater part of the stages of development of the Ferns as described by Hofmeister, and can bear testimony to the general correctness of his statements. I hope shortly to publish a complete account of the germination from my own observations.

† It may be mentioned that Hofmeister's researches on the development lead him to regard the Fern *fronds* as *branches* and the *ramenta* as true leaves.

Lycopodiaceæ.

Two forms of the spore-fruits are known to exist in the species included under the genus *Selaginella*, the *oophoridia* producing four *large* spores, and the *antheridia* producing a large number of *small* spores. Both kinds have not been discovered in all the Lycopodiaceæ; but in the genus *Selaginella* in which they do occur, very remarkable facts have been observed in regard to the development of the spores after leaving the spore-fruits.

The *small spores*, from the *antheridia*, after lying a certain time on the damp earth, burst and emit a number of cellules, each of which bursts and discharges a *spermatozoid* closely resembling that of the Ferns and Equisetaceæ (Pl. XVII. D. fig. 8).

The *large spores* when examined soon after their emission from the *oophoridia* are found to have a layer of minute cellular tissue at the upper end beneath the external tough coat of the spore, and opposite the part where this subsequently bursts open by valve-like flaps (Pl. XVII. D. fig. 1). After a time a number of peculiar organs are developed in this cellular expansion or *prothallium*, essentially analogous to the *archegonia* or *'ovules'* of the Ferns, each consisting of a cellular papilla with a central canal leading down to a free cell lying in a cavity in the *prothallium* (Pl. XVII. D. fig. 2–5). It is presumed that a process of impregnation takes place here through the agency of the *spermatozoids* of the small spores, after the outer coat of the large spore has burst at its apex so as to lay bare the cellular *prothallium* with its *archegonia*. The free cell then begins to grow and subdivide, and elongates into a filament which grows down into the cellular tissue which now occupies part of the cavity of the spore. Its terminal cell there becomes developed into a cellular mass (D. fig. 6), upon which a bud with a radicle are soon distinguishable; from this bud arises the characteristic leafy stem of the new plant of *Selaginella* (D. fig. 7), and at the same time an adventitious root grows out (the primary radicle remaining abortive). This embryo, as it may be called, then bursts through the *prothallium* and grows out into the ordinary form of the species.

A similar series of phænomena have been observed in *Isoëtes lacustris*. The small spores here also produce *spermatozoids*; while the large spores have a *prothallium* developed within the outer spore-coat, on which *archegonia* are developed, and in one of these a filamentous *suspensor* grows down, as in *Selaginella*, into the cavity of the spore (which here becomes quite filled up with cellular tissue), where it is developed into an embryo with bud and radicle, from which the plant arises and bursts through the coats of the spore.

The conditions of those Lycopodiaceæ in which only one kind

of spore has hitherto been found, is as yet obscure, but the above observations have been made by MM. Hofmeister and Mettenius, and so far as the existence of the *prothallium* with the *archegonia* in *Selaginella,* and the development of the embryo at the end of a *suspensor* growing down from the *prothallium* are concerned, I can confirm them from my own observations. I have not yet succeeded in seeing the spermatozoid produced from the small spores, which however I found burst and empty among the germinating large spores. As the processes above described occupy several months after the discharge of the spores from the *antheridia* and *oophoridia,* there is some difficulty in observing all the conditions.

Hofmeister suggests, that in the genus *Lycopodium,* where there is only one kind of spore, a *prothallium* is formed, which, like that of the Ferns, produces both *archegonia* and *antheridia.*

The relations of the course of development here to what we meet with in other families of the vegetable kingdom, will be spoken of presently in a general summary.

Rhizocarpeæ.

The morphological import of the two kinds of spores of *Pilularia,* asserted by Schleiden, has proved correct, although his views with regard to the nature of the process of impregnation have been refuted. The small spores (described above as pollen-grains) have been discovered to bear the closest affinity with those of *Selaginella* and *Isoëtes,* since shortly after their emission from the spore-sacs they burst and discharge cellules containing spiral filaments (*spermatozoids*) (Pl. XVII. C. fig. 1), which soon break out and swim freely about in the water. The sacs which produce the small spores therefore represent the *antheridia* here.

The *archegonia* are closely allied to those of *Selaginella,* but in *Pilularia* only one is formed on each large spore. The large spore soon after it becomes free exhibits a cellular growth, forming a *prothallium* analogous to that of *Selaginella* at its upper end, in which a central large cell becomes visible. The cells of the *prothallium* multiply, and it projects at its apex through the summit of the spore, the triangular lobes of the spore-coat separating to expose it. The four cells above the large central cell grow out into papillæ (which Schleiden mistook for pollen-tubes), and an intercellular passage is produced leading down to the large central cell, in all probability affording access to a fecundating *spermatozoid* (Pl. XVII. C. fig. 2, 3). This single central *archegonium* very closely resembles those found in the analogous *prothallia* of *Selaginella* and *Isoëtes.* There is never more than one developed. When the *spermatozoids* can have access, the large cell of the

archegonium soon exhibits a new development (C. fig. 4), which results in the formation of an embryo, from which the new plant grows up.

The prothallium of *Marsilea* is developed in a similar manner, and likewise produces only one *archegonium*; the cells bounding the canal of this do not grow out in papillæ like those of *Pilularia*.

Salvinia presents some points of difference. It has been observed that the small spores remain coherent together even after their sporangium is ripe, and cannot be isolated; but when such a sporangium is compressed, in water, under the microscope, there escape from its ruptured walls ellipsoid cells divided into two to six chambers, in each of which subsequently appear one to four minute cellules, in the interior of which are developed *spermatozoids* just like those of the Ferns.

The *prothallium* is produced by the large spores much in the same way as in *Pilularia* and *Salvinia*, but in addition to the *archegonium* at the apex, several others are subsequently developed around it. The embryo is developed from the basal cell of the *archegonium*, and, according to Hofmeister, never when the small spores are carefully removed from contact with it. In very rare cases *two archegonia* produce embryos. The import of the structures met with in *Azolla* is still very obscure, yet the discoveries, just referred to in the other Rhizocarpeæ, would lead us to imagine that there is a close analogy between the two kinds of organ found in that genus and those met with in *Pilularia*, &c.

If I might hazard a conjecture, I should be inclined to suppose the cellular lobes found in the upper part of the ovule-like sporangium of *Azolla* to be the *prothallium*; the 'points' seen upon the cellular structure, which afterwards becomes divided into the nine lobes, might possibly be *archegonia*; but this is a subject on which it is dangerous to venture without further examination of the organs.

Fertilization of Phanerogamia.

In no department of physiological botany have greater advances been made within the last few years than in the study of the sexual reproduction of plants. The particulars related in the last few pages sufficiently demonstrate this in reference to the Cryptogamia, and it will be seen to hold of the Phanerogamia from what follows.

Most important contributions have been furnished to the subject by R. Brown, Amici, Mohl, Hofmeister, Tulasne and others, and I have satisfied myself of the truth of Amici's views as opposed to those of Schleiden. It has proved however that the subject is not so simple as was imagined, while the re-

searches of R. Brown and Hofmeister have revealed most important facts with regard to the fertilization of the ovules of the Coniferæ, which afford a link connecting the sexual reproduction of the vascular Cryptogamous plants most closely with that of the Angiospermous flowering plants. But although the processes in the Conifers stand intermediate between those of the Rhizocarpeæ, &c., and those of the flowering plants, they are so much simpler in the latter that it will make the explanation clearer to take them first.

Angiospermous Flowering Plants.

One of the simplest cases is that of *Orchis Morio*. The ovule springs from the placental surface as a single projecting cell, which by subdivision soon becomes a cellular papilla (the *nucleus*) composed of a central cell (the *embryo-sac*) surrounded by a simple cellular layer. The two coats gradually grow up over this, and by the greater elongation of one side the ovule becomes anatropous. The nucleus meanwhile loses its cellular coat, apparently by absorption, and appears as a large oval sac inclosed in the coats, consisting in fact merely of an embryo-sac. In the apex of this, about the epoch when the pollen falls upon the stigma, three cellules (*embryonal vesicles*) make their appearance at the upper end of the embryo-sac, formed apparently by free cell-formation around a globule of protoplasm. The pollen-masses on the stigma send down pollen-tubes which traverse the conducting tissue of the style and make their way to the placentas, where they enter ordinarily singly (sometimes more than one) into the micropyle canals of the ovules, and come in contact with the outside of the apex of the embryo-sac, immediately above where the *embryonal vesicles* lie; but the pollen-tube does not penetrate the embryo-sac (Pl. XVII. F. fig. 1,2,3). Soon after the pollen-tube has reached the embryo-sac, one (very rarely two) of the embryonal vesicles begins to swell, becomes divided by a cross septum into two cells (F. fig. 4, 5), and while the upper one grows out in a filamentous form through the micropyle, by a continued process of cell-division, the lower cell enlarges and divides repeatedly so as to form a cellular globule, the *embryo* (F. fig. 6), which in this plant does not go on to produce a cotyledon and radicle, as in most other cases. The filamentous prolongation, the use of which is not evident, but which seems analogous to the *suspensor* presently to be mentioned, meanwhile decays away.

In other cases the details of the process are considerably modified. In the Cruciferæ and Scrophulariaceæ for example, the embryo-sac is a large cavity in the substance of a cellular nu-

cleus of considerable magnitude; and while the *embryonal vesicles* are produced in the upper part of the embryo-sac, a large number of free cellules are produced in the lower and middle parts (the *endosperm-cells*) (Pl. XVII. F. fig. 8 *c*). The pollen-tube has here to break through the cellular tissue of the apex of the nucleus which clothes the summit of the embryo-sac; and the *embryonal vesicle*, which becomes impregnated, grows at first into an elongated cylinder (the *suspensor*) (Pl. XVII. F. fig. 7, 8 *b*), which becomes divided by cross walls into a row of cells, the lowermost of which becomes developed into the *embryo* (F. fig. 8, 9). This then proceeds in its growth, and in the Dicotyledons is converted into the embryo with two cotyledons and a radicle, in the Monocotyledons into one with one cotyledon (or with the rudiment of a second) and a radicle; in the course of this growth mostly causing the *endosperm* to disappear by absorption, to make room for it; in many cases even obliterating the nucleus (in the exalbuminous seeds). In *Nymphæa* the endosperm is not wholly absorbed, but remains surrounding the embryo, while the nucleus forms a layer exterior to this organ, so that this plant has a double albumen.

The above views are diametrically opposed to those of Schleiden, who, nevertheless, still maintains his original opinions, and moreover has been supported in an elaborate essay by his pupil Schacht. But the balance of evidence is decidedly against him, and, as far as *Orchis* is concerned, I am convinced from my observations that he is in error.

Gymnospermous Flowering Plants.

The remarkable bodies called by their discoverer, Mr. Brown, *corpuscula*, and the polyembryony, found in the ovules of Conifers, have recently acquired great importance in the theories of reproduction, as will be seen presently. The following account of the process of fertilization in the Coniferæ is derived from Hofmeister.

The ovule of the Conifers consists of a short and thick nucleus inclosed in a single, somewhat fleshy integument, leaving a wide micropyle canal open (Pl. XVII. E. fig. 1). At the time when the pollen is shed the nucleus consists of delicate cellular tissue, containing deep in its substance an *embryo-sac* (E. fig. 1 *b*), formed by the coalescence of a vertical series of a few cells; *Taxus* has often three *embryo-sacs* at first, the Abietineæ and Juniperineæ seldom more than one. The pollen-grains pass through the wide micropyle and come in contact with the summit of the nucleus, into the substance of which they send their pollen-tubes. This takes place very soon in *Taxus* and *Juniperus*, but not for several

weeks in the Abietineæ; in *Pinus sylvestris* and others the pollen-tubes are not produced till still later.

At this time the embryo-sac is a simple cell; but shortly after, numerous free cell-nuclei appear in its cavity, and it soon becomes filled up with cellular tissue, which goes on increasing in those Abietineæ which require two years to ripen their seeds, till the following winter season; the cells of the nucleus are much multiplied meanwhile. In March and April of the following year the *endosperm-cells* multiply still more, and by absorption of the walls of the parent-cells are set free, while the embryo-sac inclosing them grows to more than twenty times its former size. These cells become applied in layers to the walls of the embryo-sac, until it at length again appears filled with cellular tissue (Pl. XVII. E. fig. 2 *b*). After the embryo-sac has become filled with cellular tissue, certain of the cells at the micropyle end of it become larger than the rest, and grow into large cells (the *corpuscula*) (E. fig. 3 *d*). Each of these *corpuscles* is separated originally from the surface of the embryo-sac by a simple cell; this latter divides into four by two vertical septa crossing each other, and then an intercellular passage is formed between their inner angles leading down to the *corpuscle* (E. fig. 4 *e*).

The number of *corpuscles* is from three to five in *Pinus sylvestris* and *austriaca*; mostly three in *Abies balsamea* and *pectinata*; generally four (rarely five) in *Pinus canadensis*; and five to eight in *Taxus* and *Juniperus*.

Free cells are next produced in the cavity of each *corpuscle* (E. fig. 4, 5 *d*); some of them usually appear as it were pressed against the upper end, and usually one at the lower end (E. fig. 5 *f*). About the time the *corpuscles* become evident the pollen-tubes resume their growth, advancing by breaking down the tissue of the nucleus until they come in contact with the outside of the embryo-sac, one over each *corpuscle* (E. fig. 3 *c*), while they perforate the membrane of the embryo-sac to come into the canal leading between the four cells down to the outside of the *corpuscle*, with which they finally come in contact (E. fig. 5 *e*). Very soon after this, the cell at the lower end of the corpuscle (the *embryonal vesicle*) becomes greatly enlarged. In this a free cell is found (E. fig. 6 *f*) which divides by a vertical septum into two collateral halves (fig. 7), and then by another vertical septum at right angles into four elongated cells; these are each divided by a cross-wall, so that this cellular body (the *proembryo*) consists of a short cylinder composed of eight cells. The four lower cells elongate and become divided again by cross walls (fig. 8, 9); and as the side walls of the upper cells are adherent to the walls of the *corpuscle*, the growth causes the lower end of the *corpuscle* to be pushed downwards; finally this gives way, while the cells of

the *proembryo* becoming much elongated, drive the point of the *proembryo* deep into the substance of the nucleus (E. fig. 10, 11), which at this time becomes lax and half-dissolved. The longitudinal series of cells, of which each *proembryo* presents four, now become isolated into filaments (*suspensors*) (E. fig. 12, 13), and the cell at the lower extremity of each *suspensor* becomes divided repeatedly to form an *embryo* (E. fig. 13 *g*), so that at this time there are four times as many rudimentary *embryos* as there are *corpuscles* *. Out of all these only one becomes fully developed; the rest are arrested and displaced by the growth of that one which forms the *embryo* of the ripe seed.

Before leaving the subject, we may advert to the idea lately propounded by Geleznoff, from his researches on the Larch, that the embryo is formed from a cellule which originates in the end of the pollen-tube and passes through an orifice into the corpuscle. This idea may easily have arisen from imperfect observation, and cannot be readily connected with anything observed by other authors.

Review of the Phænomena of Reproduction in the Flowerless and Flowering Cormophytes.

The discoveries which have been made within the last few years seem to leave little doubt of the existence of sexuality, down to the lowest of the Cormophytes, even if we refuse to admit the evidence of its probable extension to the Thallophytes, and so throughout the vegetable kingdom.

It is impossible moreover to mistake the striking connexion between the various forms of the reproductive structures which present themselves in the different groups; and it may be worth while to examine this point briefly here.

In the Angiospermous flowering plants, we find the perfect plant producing pollen and ovules in distinct organs: the pollen falling upon the stigma developes tubular prolongations which pass down into the ovary and enter the ovules, where they come in contact with the embryo-sac, and thus fertilize an embryonal vesicle existing in the interior of that sac (a greater or less quantity of endospermous cells also exists there). This then undergoes subdivision into two cells, and while the upper of the pair of cells thus formed is developed more or less into a confervoid filament, called the *suspensor*, the lower cell becomes developed into the embryo (mostly causing the absorption of the endosperm), which acquires its distinct form with one or more cotyledons, and a radicle, before it is cast off from the parent. We

* This resembles the process in Mosses when the spore produces a confervoid body, from which a number of stems bud out.

may say that these plants undergo all their metamorphoses within the ovary, and are separated from the parent as rudimentary perfect plants.

In the Gymnosperms, the Conifers and the Cycads, the conditions are more complicated. The carpels being open here, the ovules are exposed and the pollen-grains come immediately to the micropyle of the ovules instead of to a stigma; and the pollen-tubes have to traverse only the substance of the nucleus to reach the embryo-sac. But while the external conditions are thus simple, those of the embryo-sac are much more complicated. The endospermous cellular tissue formed within it becomes a mass filling up its cavity, and on the upper end of this appear several structures, the *corpuscles,* presenting the most striking resemblance to the *archegonia* of *Selaginella,* &c., consisting of an enlarged cell crowned by four cells, leaving an intercellular canal between them running down to the large cell. A pollen-tube makes its way to, and passes down each of these canals, to fertilize the central cell of each corpuscle; just as Suminski and De Mercklin describe a spermatozoid to pass down the canal of the *archegonium* of the Ferns. The central cell then produces four *suspensors,* at the end of each of which a rudimentary embryo presents itself*—only one becoming fully developed. The growth of these *suspensors* down from the central cell of the *archegonium* or *corpuscle* is precisely analogous to the growth of the *suspensor,* producing the embryo at its extremity, in *Selaginella* and *Isoëtes.*

The relations to the higher flowering plants are here clear enough; the difference existing only in the superaddition of all the stages of development of the endospermous tissue between the entrance of the pollen-tubes and the development of the embryonal vesicles into the *corpuscles,* the central cells of which are *physiological* analogues of the embryo-sac of the higher Phanerogamia; while the embryo-sac itself is the *morphological* analogue.

The relations to the lower plants are more diversified; they are closest in the cases of *Selaginella* and *Isoëtes,* which is the more interesting on account of the many other affinities between the Coniferæ and Lycopodiaceæ. The large spore of *Selaginella* is analogous to the ovule of a Gymnosperm, its internal coat to the embryo-sac. The cellular *prothallium,* which is developed at the summit of the cavity of the large spore of *Selaginella,* represents the endospermous tissue of the Gymnosperm, and the *archegonia* of the former are recognized in the *corpuscles* of the latter. Thus, as in these *corpuscles,* cells become developed so as to

* This resembles the budding of several leafy stems from the Moss-spore.

form *suspensors,* bearing embryos which they carry down into the substance of the lower part of the ovule. In *Selaginella* the germ-cell of the *archegonium* grows down into a *suspensor,* and developes the *embryo* in the cellular tissue inside the cavity of the spore quite below the *prothallium.*

The principal difference in *Salvinia* seems to be the absence of the *suspensor,* the embryo originating in the substance of the *prothallium,* which has several *archegonia. Pilularia* differs again from *Salvinia* in having only one *archegonium.*

In these tribes of the Cryptogamia, the stage of development in which the *prothallia* with the sexual organs appear—after the spores have become entirely separated from the parent, thus constituting separate entities,—is comparatively brief; it is a transitory stage of the development of the forms representing the species; the *prothallium* being moreover very inconspicuous and almost wholly inclosed in the spore-coat.

We find a very great difference in the Ferns and Equisetaceæ, which may be grouped together. Here the representatives of the pollen-grains, the small spores, disappear, or at least only one kind of spore is formed; from this is developed a *prothallium,* which becomes a more important and conspicuous structure. No longer hidden in the spore-coat, it grows out into a Marchantia-like frond, well-provided with chlorophyll, having root-fibrils, and lasting, especially in the Equisetaceæ, many months. This structure produces not only *archegonia,* but also *antheridia,* emitting *spermatozoids.* Hence the *prothallium* here combines the analogy to the *endospermous tissue* of the embryo-sac of the Gymnosperms with an analogy to the pollen-mass. Hence while the stems and fronds of the Ferns, and the shafts of the *Equiseta* are represented by the stem and leaves of the Gymnosperms, the fertile fronds and spikes of the former find their analogues in the cones of the latter. The spike of the *Equisetum* closely resembles the cones of some Conifers; the fertile fronds of the Ferns, especially in certain cases, approach to the cones of the Cycads, with their numerous ovules on abundant anthers upon each scale or leaf. The male and female influence lie as yet combined in the spores of the Ferns and *Equiseta,* to become disentangled during the development of the *prothallium*; the sexual influences are already separated in the cones of the Conifers and Cycads, where the uniform spore of the Filicoids is represented respectively by the *pollen-mass* or the *embryo-sac* of the ovule.

The Mosses present another kind of *disintegration* of the specific form, if it may be so termed, into distinct existences, the conditions of the *prothallium* and the spore-bearing generation being reversed here; the former being the more permanent,

the latter transitory. Moreover we have the two forms here existing contemporaneously, the *prothallium* or fruit-form constituting the vegetative structure which nourishes the spore-bearing form, here reduced to a sporocarp; while in the higher forms the *prothallium* disappears soon after it gives birth to the leafy spore-bearing plant.

The spore of the Mosses and Hepaticæ represents the spore of the Ferns, the large and small spores (combined) of the Lycopodiums and Rhizocarpeæ, and a combination of the pollen and embryo-sac of the Gymnosperms*. When it germinates it produces the leafy plant, representing the *prothallium* of the higher Cryptogamia and the *endospermous tissue* of the Gymnosperms (and Angiosperms), and bearing *antheridia* and *archegonia*. The *archegonia* then produce the spore-fruits, which represent the fertile fronds of the Fern, the spikes of *Equisetum*, the sporocarps (collectively) of the Lycopodiaceæ and Rhizocarpeæ, and, lastly, the anthers and ovaries of flowering plants. Therefore in the Mosses we have nothing homologous with the stem and leaves of the higher Cryptogams and flowering plants in this spore-bearing form; these are only developed in the *prothallium*-form†.

Looking at the more perfect Mosses alone, this idea of the morphological relations of the leafy Moss-plant, of the *prothallium*, namely, to the endosperm of Phanerogamia, seems rather difficult to accept; but when we examine more closely into the various forms included under the families of Mosses and Hepaticæ, it becomes less remarkable. The separation of these two groups is by no means natural. There are no essential differences in the *antheridia* and *archegonia* of the Mosses and Hepaticæ, and in the fully developed condition of their spore-bearing structures there is no *universal* character which will separate them. Many of the leafy *Jungermanniæ* have the Confervoid development of the *prothallium* from the spore; the *Jungermanniæ* have a *vaginule*, as also *Radula* and *Anthoceros*; this last has a *columella*, but like *Riccia* it is destitute of *elaters*. So that if with Hofmeister we divide the plants belonging to these two families into four groups,—1. Mosses; 2. Jungermanniæ; 3. Marchantiæ, Targioneæ and Riccieæ, and 4. Anthoceroteæ,—they collectively form quite as natural a family as the Ferns or Rhizocarpeæ. Then looking to the lower forms of this family, we

* Since some Mosses are diœcious, the sexual influence is represented even in the spores; some are embryo-sac spores, others *pollen-spores*; but both kinds produce a *prothallium*.

† There is also a further separation of existences in the Mosses and some Hepaticæ, for the spore produces a Confervoid body from which several stems bud out; this resembles the polyembryony of Gymnosperms.

find the *prothallium,* as in *Sphærocarpus* and *Anthoceros,* reduced to a cellular structure little more complex than the *prothallium* of a Fern, which affords a link connecting it with that of *Selaginella,* &c., and so with the endospermous tissue of the Gymnosperms.

Finally, in the Characeæ we seem to meet with a group reduced to a *prothallium,* bearing *archegonia* (*nucules*) and *antheridia* (*globules*), in which the sole result of fertilization is the development of a new *prothallium* from the central cell of the *archegonium,* no spore-bearing form coming to light; and thus we get the opposite extremity of the scale, at the head of which stand the Angiospermous flowering plants where the *spore-producing* form alone is represented, since the formation of the endosperm-cells in the embryo-sac before fertilization only affords the most distant trace of its analogy to the *prothallia* of the Cryptogams, an analogy which is only rendered clear by the interposition of the Gymnosperms where this endosperm exhibits so many characters relating it to the *prothallium* of *Selaginella,* &c.

The following is a tabular view of the conditions which present themselves more or less distinctly in the Phanerogamia and higher Cryptogamia.

The column marked *Embryonic Form* shows the growth or increase taking place in the *embryonal vesicle* or *germ-cell* previously to its development into the new plant or plants of the *vegetative form.* Where the 0 is placed it signifies that the embryonal cell of the *archegonium* becomes directly developed into one new plant of the vegetative form.

The 0 placed in the column of the vegetative system of the Hepaticæ and Musci indicates the absence of this, since the impregnation results in the growth of the *sporangium,* which remains attached to the persistent vegetative organs of the *sexual form.*

[The bud-like nature of the production of the spores in the higher Cryptogams is strongly indicated in a monstrous specimen of *Eucamptodon perichætialis,* Mont., described in the Annals of Nat. Hist. vol. xvi. p. 354, by Dr. Montagne, where the sporangia were filled with *gemmæ* like those of Liverworts, in the place of spores.]

Groups.	Vegetative Form (multiplied by cell-division).		Sexual Form (with Impregnation).		Embryonic Form.
	Vegetative System.	Reproductive System.	Vegetative Organs.	Reproductive Organs.	
A. Characeæ	0	0	A branching cellular stem-like plant (monœcious or diœcious).	Archegonia and antheridia.	A cellular filament from the free cell of the archegonium buds out into several stems of the sexual form.
B. Hepaticæ and Musci.	0	Sporangium with spores of one kind. Spore sometimes germinating into a Confervoid filament from which several stems bud.	A cellular frond or a leafy stem (monœcious or diœcious).	Archegonia and antheridia.	0
C. Ferns and Equisetaceæ.	A stem with excessively developed leaves (Ferns), or stems with rudimentary leaves (Equiseta).	Sporangia on more or less modified leaves producing one kind of spore.	A minute cellular frond (*prothallium*), androgynous (always ?).	Archegonia and antheridia.	0
D. Lycopodiaceæ and Rhizocarpeæ.	A leafy stem.	Sporangia (in the Rhizocarpeæ contained in spore-fruits), producing separately large spores, and	Large spores: a cellular prothallium within the spore.	Archegonia	A filamentous suspensor slightly developed in Lycopodineæ and Isoëtes.
		small spores	Small spores	Cellules containing spermatozoids.	
E. Gymnosperms.	A leafy stem.	Cones composed of modified leaves, bearing naked ovules, or	Endosperm developed in the embryo-sac into a kind of prothallium.	Corpuscles	Embryonal vesicle giving origin to four suspensors, which each produce an embryo. All abortive but one.
		pollen-grains		Pollen-tubes.	
F. Angiosperms.	A leafy stem.	Flowers composed of modified leaves, presenting at last the form of carpels containing ovules, and	Endosperm-cells, usually fugitive.	Embryonal vesicle.	Suspensor of the embryo more or less developed.
		anthers containing pollen		Pollen-tubes.	

A curious law presented itself to me in the contemplation of this table; in each of the three "forms" under which the different conditions of organization are arranged, a *multiplication* may take place. *Now this is effected through a different kind of cell-formation in each "form."*

Cells are formed in three ways:—

1. By subdivision of an old cell which may become enlarged in one or more directions, or may bud out laterally, before the formation of the septum which divides it into two or more chambers.

2. By subdivision of the entire contents of the parent-cell into four or more portions, between which septa are usually formed, but which then acquire special coats inside, and by the solution of the parent-cell and the septa become free.

3. By the formation of a membrane around a small globular mass of contents (*nucleus*) which has become isolated in the cavity of the cell.

In the 'Vegetative form,' the formation of spores and pollen-grains is effected by the *second process*. [The embryo-sac of Phanerogams is formed by the simple enlargement of a cell or several coalescent cells of the tissue of the nucleus.]

In the 'Sexual form,' the germ-cell of the *archegonium*, which is impregnated by the spermatozoid, is stated to be formed by the *third process*, free cell-formation around a nucleus, and the embryonal vesicle of the Phanerogams certainly originates in this manner.

In the 'Embryonic form,' the multiplication which takes place in Characeæ, Mosses, and in the suspensors of Conifers, is effected by *cell-division*, in the first two cases preceded by budding; this is the *first* process, and that which occurs universally in the *growth* of tissues.

Recent Literature of the Subject.

1. Amici. On the Fecundation of the Orchideæ. (Memoir read at the Italian Scientific Congress, Genoa, 1846.) Abstracted in *Annales des Sc. Nat.* 3rd Ser. vii. 193 (1847); and in the *Botanische Zeitung*, v. 364, 1847.
2. Crüger. Ueber Befruchtung bei den Orangen. *Botanische Zeitung*, iv. 57, 1851.
3. Geleznoff. Mémoire sur l'Embryogenie du Melèze. *Ann. des Sc. Nat.* 3rd Ser. xiv. 189, 1850.
4. Henfrey. On the Development of the Ovule in *Orchis Morio*. *Proceedings of the Linnæan Society of London*, April 3, 1849.
5. Hofmeister. Untersuchung des Vorganges bei der Befruchtung der Œnothereen. *Botanische Zeitung*, v. 785, 1847. Abstracted in *Ann. des Sc. Nat.* 3rd Ser. ix. 65, 1848.
6. ———. Die Enstehung des Embryo der Phanerogamen: 4to, Leipzig, 1849. Abstract in *Ann. des Sc. Nat.* 3rd Ser. xi. 375, 1849.

7. HOFMEISTER. Ueber die Fruchtbildung und Keimung der höherer Kryptogamen. *Botanische Zeitung*, vii. 793, 1849.
8. ———. Vergleichende Untersuchungen der Keimung, Entfaltung und Fruchtbildung höherer Kryptogamen: 4to, Leipsic, 1851.
9. ———. Zur Entwickelungsgeschichte des Embryo der Personaten. *Flora*, 1851, 450.
10. ———. Ueber die Stellung der Moose im Systeme. *Flora*, 1852, 1.
11. ———. Zur Entwickelungsgeschichte der *Zostera*. *Botanische Zeitung*, x. 121, 1852.
12. MERCKLIN. Beobachtungen an dem Prothallium der Farrnkräuter: St. Petersburgh, 1850.
13. ———. Zu den Untersuchungen über die Entwickelungsgesch. der Farrnkräuter. *Linnæa*, 1850, 723.
14. METTENIUS. Beiträge zur Kenntniss der Rhizocarpeen: 4to, Frankfurt, 1846.
15. ———. Beiträge zur Botanik, Heft i. 8vo, Heidelberg, 1850.
16. MILDE. Ueber Antheridien bei keimenden Equiseten. *Botanische Zeitung*, viii. 448, 1850.
17. ———. De sporarum Equisetorum germinatione. *Linnæa*, 1850, 545.
18. MOHL. Ueber die Entwickelung des Embryo von *Orchis Morio*. *Botanische Zeitung*, v. 465, 1847. Abstracted in *Ann. des Sc. Nat.* 3rd Ser. ix. 24, 1848.
19. MÜLLER, K. Beiträge zur Entwickelungsgesch. des Pflanzen-Embryo. *Botanische Zeitung*, v. 737, 1847. Abstracted in *Ann. des Sc. Nat.* 3rd Ser. ix. 33, 1848.
20. NÄGELI. Bewegliche Spiral-fäden (Saamen-fäden) an Farren. *Schleiden und Nägeli, Zeitschrift f. wiss. Botanik*, Heft i. 168, 1844.
21. ———. Ueber die Fortpflanzung der Rhizocarpeen. *Ibid.* Heft iii. & iv. 188, 1846. Abstracted in *Ann. des Sc. Nat.* 3rd Ser. ix. 99, 1848.
22. PINEAU. Recherches sur la Formation de l'Embryon chez les Conifères. *Ann. des Sc. Nat.* 3rd Ser. xi. 83, 1849.
23. SCHACHT. Entwickelungsgeschichte des Pflanzen-Embryo. (*Verhand. Nederlandsch. Koninkl. Instituut*): 4to, Amsterdam, 1850. Abstracted in *Ann. des Sc. Nat.* 3rd Ser. xv. 80, 1850.
24. ———. Beiträge zur Entwickelungsgeschichte der Farrnkräuter. *Linnæa*, 1849, 753.
25. ———. Ueber Antheridien der Lebermoose. *Botanische Zeitung*, x. 153, 1852.
26. SCHIMPER. Recherches anatomiques et physiologiques sur les Mousses: 4to, Strasburg, 1848. Abstract in the *Flora*, 1848, 673.
27. SCHLEIDEN. Grundzüge der wissenschaftliche Botanik, vol. ii. 3rd edition, Leipsic, 1850.
28. SUMINSKI. Zur Entwickelungsgeschichte der Farrnkräuter: 4to, Berlin, 1848. Abstracted in *Ann. des Sc. Nat.* 3rd Ser. xi. 114, 1849. *Annals of Natural History*, 2nd Series, iv. 339, 1849.
29. THURET. Sur les Antheridies des Fougères. *Ann. des Sc. Nat.* 3rd Ser. xi. 5, 1849.
30. ———. Mémoires sur les Antheridies, Part 2. *Ibid.* xvi. 5, 1852.
31. TULASNE, L. R. Etudes sur l'Embryogenie végétale. *Ann. des Sc. Nat.* 3rd Ser. xii. 21, 1849.
32. WIGAND. Zur Entwickelungsgesch. de Farrnkräuter. *Botanische Zeitung*, vii. 17, 1849. Abstracted in *Ann. des Sc. Nat.* 3rd Ser. xi. 126, 1849.

The two following papers, which preceded all the above by several years,

should be consulted in reference to the Coniferæ, since so much new interest now attaches to the facts revealed in them.

Brown, R. On the Plurality and Development of the Embryos in the Seeds of the Coniferæ. Read before the British Association at Edinburgh, August 1834. *Ann. des Sc. Nat.* 2nd Ser. Bot. xx. 193; Annals of Nat. History, Ser. 1. xiii. 368.

Mirbel and Spach. Notes sur l'embryogénie des *Pinus Laricio* et *sylvestris*, &c. *Ann. des Sc. Nat.* 2nd Ser. Bot. vol. xx. 257.

EXPLANATION OF PLATE XVII.

A. *Hepaticæ.*

Fig. 1. *Jungermannia bicuspidata.* An archegonium recently impregnated (*b*), with another (*a*) unimpregnated. The first contains a rudimentary fruit composed of two cells. In the inside of the perianth inclosing the archegonia were found several moving spermatozoids; the arrows indicate the direction of the movements. (*Hofmeister.*)

Fig. 2. A rudimentary fruit extracted from a somewhat older archegonium of the same plant. (*Hofmeister.*)

B. *Filices.*

Fig. 1. *Asplenium septentrionale.* A vertical section of an archegonium, just impregnated. (*Hofmeister.*)

Fig. 2. Vertical section of the prothallium of the same plant, passing through an embryo developed from the globular cell of the archegonium; the archegonium (*a*) is seen pushed aside by the enlargement of the embryo. (*Hofmeister.*)

Fig. 3. Antheridia of *Pteris aquilina*: *a*, unopened; *b*, just bursting; *c*, older one which has the walls of its cavity coloured brown. (*Thuret.*)

Fig. 4. Spermatozoids from *Asplenium septentrionale.* (*Hofmeister.*)

C. *Rhizocarpeæ.*

Fig. 1. *Pilularia globulifera.* Small spore. The inner coat, which has become protruded through the fissure of the outer coat, bursts and discharges cellules, from some of which spermatozoids are extricating themselves. (*Hofmeister.*)

Fig. 2. The same plant. Vertical section of a prothallium with central archegonium, just before impregnation. (*Hofmeister.*)

Fig. 3. The same plant. Archegonium seen from above. (*Hofmeister.*)

Fig. 4. The same plant. Vertical section of the prothallium with the embryo in an advanced stage of development (*a*, archegonium). (*Hofmeister.*)

D. *Lycopodiaceæ.*

Fig. 1. *Selaginella Martensii.* The inner coat of a large spore recently discharged from the capsule, with the outer coat stripped off, so as to show the young prothallium at the upper end. (*Hofmeister.*)

Fig. 2. *Selaginella denticulata.* Vertical section of the prothallium and upper half of a large spore, eleven months after sowing. Several archegonia are seen, one of which exhibits a central cell. (*Hofmeister.*)

Fig. 3. An archegonium of *Selaginella Martensii.* (*Hofmeister.*)

Fig. 4. An archegonium of *Selaginella denticulata* just impregnated, the central cell divided into two by a cross wall. (*Hofmeister.*)

Fig. 5. An archegonium seen from above. (*Hofmeister.*)

Fig. 6. Vertical section of the prothallium and upper part of the large spore of *Selaginella denticulata*, showing the embryo developed from the central cell of one of the archegonia, carried down by the growth of its suspensor, so as to be imbedded in the cellular tissue filling the upper part of the cavity of the spore. (*Hofmeister.*)

Fig. 7. Young embryo of *S. denticulata* breaking through the prothallium, its bud now outside the spore. (*Hofmeister.*)

Fig. 8. Small spore of *Selaginella helvetica* bursting and discharging cellules containing spermatozoids. (*Hofmeister.*)

E. *Phanerogamia Gymnospermia.*

Fig. 1. Vertical section of an ovule of *Pinus austriaca*, from a cone just flowered: *a*, nucleus; *b*, embryo-sac.

Fig. 2. Vertical section of the ovule of *Pinus sylvestris* in May of the second year: *b*, embryo-sac filled with cellular tissue; *c*, pollen-tubes penetrating the nucleus.

Fig. 3. Portion of the embryo-sac and upper part of the nucleus of *Pinus Strobus*: *b*, embryo-sac; *c*, pollen traversing the tissue of the nucleus (*a*); *d*, corpuscles.

Fig. 4. Vertical section of a corpuscle of *Abies excelsa* just ripe for impregnation: *b*, tissue filling the embryo-sac; *d*, free cells in the cavity of the corpuscle; *e*, the four cells between which the intercellular canal passes.

Fig. 5. Vertical section of a corpuscle of *Pinus Strobus*, to which the pollen-tube (*c*) has just arrived; *d*, free cells swimming in the contents; *f*, embryonal vesicle.

Figs. 6–10. Progressive stages of development of the suspensors of *Pinus Strobus*.

Fig. 11. The suspensor just before separating.

Fig. 12. The same, detached below.

Fig. 13. A suspensor (three being cut away), somewhat further advanced, with the rudimentary embryo (*g*) at the base.

(All from *Hofmeister.*)

F. *Phanerogamia Angiospermia.*

Fig. 1. Ovule of *Orchis Morio* just impregnated (original).

Figs. 2–5. Successive stages of development of the embryo.

Fig. 6. Embryo with the suspensor-like filament which grows up out of the micropyle (original).

Fig. 7. Embryo-sac of *Veronica triphyllos*: *a*, pollen-tube; *b*, suspensor. (*Tulasne.*)

Fig. 8. More advanced: *c*, endosperm-cells; *d*, embryo. (*Tulasne.*)

Fig. 9. More advanced embryo extracted. (*Tulasne.*)

XXXVII.—*Upon the Mode of Generation of an Hymenopterous Insect of the Family of the* Pteromalidæ. By Dr. Ph. de Filippi, Professor of Zoology at Turin.

[With a Plate.]

I had collected during the month of May 1851, from the vineyards near Turin, a quantity of leaves rolled up by the *Rhynchites Betuleti*, in order to study the development of the embryo in the very transparent ova, which this little Coleopterous insect lays in them. What was my surprise, however, when I saw

that the larger moiety of these ova was attacked by a parasite, and that in the interior of this parasite another was developed, which when fully grown transformed itself into a nymph within the ovum of the *Rhynchites*, and at last gave birth to a little Hymenopterous insect of the numerous family of the *Pteromalidæ*!

Here is a summary of the facts. Among the ova which have just been deposited by the *Rhynchites* upon leaves still fresh and green, there are some which are altogether clear, and which when examined by the microscope present no trace of embryonic cells. Regarding them attentively, we observe at some points of the ova a very small animalcule, like an infusorium, provided with a tail which it moves briskly with a lashing motion; but which in form, and in the hairs which beset its body, resembles certain Dipterous larvæ (Pl. XVI. A. fig. 1 & 2). In most cases there is but a single one in each ovum, but I have also seen two and even three. No organs can be distinguished in the interior of the parasite under this form; it is only later that a kind of vesicle makes its appearance in it (fig. 3, 6). Very soon the parasite loses its mobility, and the internal vesicle, increasing in size, distends the integument of the animal in which it is formed; so that the tail drawn in by this distension, ends by disappearing, and the body of the first parasite becomes reduced to a mere sac (fig. 4, 5). What I have called a vesicle becomes more and more developed, presents first the outline of a head, and begins by its vermicular motions to give signs of life (fig. 6).

It is in fact the larva of one of the *Pteromalidæ*, which, when it has arrived at its complete development, appears armed with two delicate and elongated jaws, without any trace of legs, and simply with a projecting crest on the sides of the body (fig. 7). When this larva is going to pass into the nymph condition (which takes place eight or ten days after its first appearance), it changes its skin—tears by this movement the envelope of the first parasite, and spins a cocoon, in consequence of which the ovum of the *Rhynchites* takes on a brown colour (fig. 8). Lastly, after another delay of a week or so, the little Hymenopterous insect effects an opening in the ovum and makes its exit.

I shall not at present give the figure and description of the perfect insect, which perhaps belongs to a new genus, but instead, I will rather offer a few remarks upon the facts which I have just detailed. The first question which I asked myself was, whether this might not be the case of a parasite within a parasite, that is to say, an ovum deposited by the Pteromalian female, in the body of a Dipterous larva, which feeds on the ovum of a *Rhynchites*; but many circumstances have caused me to reject this interpretation. I have examined about a hundred ova of *Rhynchites* thus attacked, and have always witnessed the series of metamorphoses

here set forth; the first parasite never continued to live and become developed on its own account. It is besides so small that it could not be perforated by the ovipositor of the Pteromalian female; and the larva of the latter is developed in its interior in a very different manner from the other *Ichneumonidæ* which arise from an ovum. The first parasite is, in truth, only the generator of the Pteromalian larva; it is, to use Steenstrup's phrase, a *nurse*. How has it been formed and introduced into the ovum of the *Rhynchites*? How do the spring broods of *Pteromalidæ* proceed? How do they live? When do they deposit the product of their new copulation? for from the state of their sexual organs we must suppose that they produce a new generation within the year. All this is to be discovered. However it may be, this insect presents the only example known at present in the class, of a true generation by nurses. The propagation of the Aphides appears to me to be a very different affair. In fact, the viviparous individuals of these insects are true females and have well-developed sexual organs: their young proceed from ova which are developed in the ordinary manner, as M. Leydig has recently demonstrated (Siebold and Kölliker's Zeitschrift für Wissenschaftliche Zoologie, vol. ii.). The course of events here, is just as if the viviparous females were fecundated by the influence of the copulation of their immediate or remote progenitors. This example of Parthenogenesis (according to the elegant expression of Mr. Owen) takes place sometimes exceptionally in other species of insects. I shall confine myself here to mentioning the singular case, which was related to me recently by a celebrated English entomologist, Mr. John Curtis, in his passage through Turin; of an isolated chrysalis of *Bombyx polyphemus* which he had received from America, and from which a female proceeded, all of whose ova produced young. I believe that the same thing sometimes takes place in the *Bombyx Mori,* although altogether separated from the males. But we cannot speak of *ova* in the interior of the *nurse* of my Pteromalian, any more than in those of the *Distomata* or in the larvæ of *Medusidæ* and *Ophiuridæ*.

Perhaps these observations may throw some light upon the complicated history of other parasitic insects, especially of *Xenos* and of *Meloë,* which has been made known to us by the beautiful investigations of Siebold and Newport.

Analogy leads us to believe that the active larvæ of these insects, provided with three pair of legs, do not become transformed into inert vermiform larvæ, but produce them: there would then be in these parasites also a nursing generation.

[The Translator feels bound to remark, first, that in his belief M. Leydig's observations do *not* lead to the conclusion that the viviparous Aphides are true females; and secondly, that

the observations of Siebold and Newport quoted, are quite sufficient to demonstrate that the active larvæ *are* transformed into the inert larvæ.]

EXPLANATION OF PLATE XVI. A.

The figures 1, 4, 6, 7 and 8 represent the ovum of the *Rhynchites* somewhat compressed in order to show the parasites more distinctly.

Fig. 1. *a*, shows the first parasite, which is seen removed from the ovum and further magnified in fig. 2.

Fig. 3. represents the same animal *a*, with the interior vesicle *b*, which is the first indication of the second parasite, or of the larva of the Pteromalian. In the following figures *a* and *b* have the same signification.

Fig. 8. A dorsal view of the nymph of the Pteromalian; *c*, the thrown-off skin; *d*, the cocoon; *e*, the shell of the egg of the *Rhynchites*.

XXXVIII.—*A Catalogue of British Spiders, including remarks on their Structure, Functions, Œconomy, and Systematic Arrangement.* By John Blackwall, F.L.S.

[Continued from p. 275.]

169. *Walckenaëra hiemalis.*

Walckenaëra hiemalis, Blackw. Linn. Trans. vol. xviii. p. 632.

Numerous individuals of this species were observed running actively on rails in meadows and pastures near Llanrwst in December 1836 and January 1837.

I cannot concur with M. Walckenaer in adding *Walckenaëra hiemalis* to the synonyma of *Argus cucullatus,* from which it differs in size, colour, and organization (Hist. Nat. des Insect. Apt. t. iv. p. 510). In the form of the anterior part of the cephalo-thorax and in the disposition of the eyes, the males of these spiders are very dissimilar.

170. *Walckenaëra bifrons.*

Walckenaëra bifrons, Blackw. Linn. Trans. vol. xviii. p. 634.
Argus bifrons, Walck. Hist. Nat. des Insect. Apt. t. iv. p. 510.

Mr. T. Glover captured an adult male of this spider, which is the only specimen I have had an opportunity of examining, in June 1838 among coarse herbage in Gwydir Wood, near Bettws y Coed, Caernarvonshire.

171. *Walckenaëra bicolor.*

Walckenaëra bicolor, Blackw. Linn. Trans. vol. xviii. p. 635.

M. Walckenaer is of opinion that *Walckenaëra bicolor* should rank as a synonym of *Argus elongatus* (Hist. Nat. des Insect. Apt. t. iv. p. 509); but they may be readily distinguished from each other by differences in size, structure, and colour.

Males of this species, with the palpal organs fully developed, were taken in July 1836 on rails near Llanrwst.

172. *Walckenaëra parva.*

Walckenaëra parva, Blackw. Linn. Trans. vol. xviii. p. 635.
Argus parvus, Walck. Hist. Nat. des Insect. Apt. t. iv. p. 508.

In December 1836 and January 1837 this minute spider was seen in considerable numbers on rails near Llanrwst.

173. *Walckenaëra depressa.*

Walckenaëra depressa, Blackw. Lond. and Edinb. Phil. Mag. Third Series, vol. viii. p. 482.

Adult males of *Walckenaëra depressa* were detected under stones in a wood at Oakland in April 1835, and in June 1837 both sexes were procured in the same locality.

174. *Walckenaëra humilis.*

Walckenaëra humilis, Blackw. Linn. Trans. vol. xviii. p. 636.
Argus humilis, Walck. Hist. Nat. des Insect. Apt. t. iv. p. 506.

Several specimens of this spider were found in October 1836 under slates in the garden belonging to Thomas Warner, Esq., of Crumpsall Green, near Manchester; others were observed afterwards on rails at Crumpsall Hall; and in 1840 Miss Ellen Clayton met with males and females of this species near Garstang in Lancashire.

175. *Walckenaëra cristata.*

Walckenaëra cristata, Blackw. Lond. and Edinb. Phil. Mag. Third Series, vol. iii. p. 107; Research. in Zool. p. 317. pl. 2. fig. 7–10.
Theridion bicorne, Wider, Mus. Senck. B. i. p. 220. taf. 14. fig. 12.
Micryphantes cæspitum, Koch, Uebers. des Arachn. Syst. erstes Heft, p. 12; Die Arachn. B. viii. p. 104. tab. 281. fig. 673, 674.
Argus bicornis, Walck. Hist. Nat. des Insect. Apt. t. ii. p. 365.

Mr. Thomas Blackwall discovered this species in October 1832 under stones and on rails in the neighbourhood of Manchester, and I have since met with it in similar situations near Llanrwst; it has also been taken near Bradford in Yorkshire by Mr. R. H. Meade.

176. *Walckenaëra antica.*

Theridion anticum, Wider, Mus. Senck. B. i. p. 221. taf. 15. fig. 1.
Micryphantes tibialis, Koch, Die Arachn. B. iii. p. 47. tab. 89. fig. 203, & viii. p. 107. tab. 282. fig. 675.
Walckenaëra apicata, Blackw. Linn. Trans. vol. xviii. p. 637.
Argus anticus, Walck. Hist. Nat. des Insect. Apt. t. ii. p. 357.
—— *apicatus,* Walck. Hist. Nat. des Insect. Apt. t. iv. p. 509.

As the *Argus anticus* and *Argus apicatus* of M. Walckenaer are the same, and are identical with *Walckenaëra antica,* I have included them among the synonyma of that species, which was observed on rails near Llanrwst in November 1837, and again in May 1838.

177. *Walckenaëra pumila.*

Walckenaëra pumila, Blackw. Linn. Trans. vol. xviii. p. 639.
Argus pumilus, Walck. Hist. Nat. des Insect. Apt. t. iv. p. 508.

Both sexes of this spider secrete themselves under stones in moist pastures near Llanrwst. The male has the palpal organs developed in May.

178. *Walckenaëra picina.*

Walckenaëra picina, Blackw. Linn. Trans. vol. xviii. p. 640.
Argus picinus, Walck. Hist. Nat. des Insect. Apt. t. iv. p. 507.

A specimen of *Walckenaëra picina,* captured in the neighbourhood of Manchester, was received from Mr. T. Glover in June 1838; and in the following month another specimen was taken near Llanrwst. Both individuals were adult males.

179. *Walckenaëra nemoralis.*

Walckenaëra nemoralis, Blackw. Linn. Trans. vol. xviii. p. 641.
Argus nemoralis, Walck. Hist. Nat. des Insect. Apt. t. iv. p. 507.

In March 1837 males of this species, in a state of maturity, were found under stones in woods about Llanrwst.

Genus Pachygnatha, Sund.

180. *Pachygnatha Clerckii.*

Pachygnatha Clerckii, Sund. Vet. Acad. Handl. 1829, p. 208, & 1832, p. 258.
—— *Listeri,* Koch, Uebers. des Arachn. Syst. erstes Heft, p. 10; Die Arachn. B. xii. p. 142. tab. 430. fig. 1064.
Manduculus ambiguus, Blackw. Lond. and Edinb. Phil. Mag. Third Series, vol. iii. p. 111; Research. in Zool. p. 359. pl. 3. fig. 3–5.
Theridion maxillosum, Hahn, Die Arachn. B. ii. p. 37. tab. 53. fig. 122.
Linyphia maxillosa, Walck. Hist. Nat. des Insect. Apt. t. ii. p. 267.
—— *Clerckii,* Walck. Hist. Nat. des Insect. Apt. t. ii. p. 270.

Arachnologists, in their endeavours to identify the species constituting the genus *Pachygnatha* of Prof. Sundevall, have involved their synonyma in a labyrinth of such perplexing intricacy as to render any attempt at revision extremely difficult. Such being the case, I submit the result of a careful investigation of the subject to the impartial consideration of zoologists, hoping that it

may tend to facilitate a more accurate knowledge of this small but interesting group.

The *Pachygnatha Listeri* of M. Koch and the *Linyphia maxillosa* of M. Walckenaer are evidently the same as *Pachygnatha Clerckii*; but the *Theridion vernale* of M. Hahn and the *Pachygnatha Listeri* of Prof. Sundevall, which are included by M. Walckenaer among the synonyma of *Linyphia maxillosa,* must not be confounded with that species and with each other, *Theridion vernale* being identical with the *Pachygnatha Degeerii* of Prof. Sundevall. As M. Walckenaer states that the description of his *Linyphia Clerckii* is borrowed from Prof. Sundevall's account of *Pachygnatha Clerckii,* I am constrained, notwithstanding the great disparity in size, to regard it as a synonym of the latter. The spider represented by M. Koch as the *Pachygnatha Clerckii* of Prof. Sundevall (Die Arachn. B. xii. p. 146. tab. 430. fig. 1067) is quite distinct from that species, and is admitted to be an immature individual by M. Koch himself, who remarks, "Ich fand sie auf einer Reise in der Nähe von Zweibrücken, aber nur Weibchen und diese nicht im Zustande vollständiger Ausbildung; ein solches stellt die hier gegebene Abbildung vor."

Mr. T. Blackwall met with *Pachygnatha Clerckii,* which pairs in October, under stones and rubbish in the township of Crumpsall, in the autumn of 1831; and I have since received specimens of it from Yorkshire and Middlesex. In it are combined several striking characteristics of the species composing the genera *Theridion* and *Tetragnatha.* Allied to the former by the structure of the oral apparatus, and by the irregularity of the insignificant web it fabricates, it resembles the latter in the form and relative length of its legs, which it frequently extends in the same manner as *Tetragnatha extensa*; thus closely connecting the *Theridiidæ* with the *Epëiridæ.*

181. *Pachygnatha Listeri.*

Pachygnatha Listeri, Sund. Vet. Acad. Handl. 1829, p. 210.
Manduculus limatus, Blackw. Linn. Trans. vol. xviii. p. 667.

The *Linyphia manducula* of M. Walckenaer (Hist. Nat. des Insect. Apt. t. iv. p. 482) is the same as *Manduculus limatus,* and, consequently, lapses into a synonym of *Pachygnatha Listeri.* This species occurs under stones and on bushes in woods about Oakland, and the male has the palpal organs completely developed in September. It has also been captured in Lancashire and Yorkshire.

In the 'Transactions of the Linnæan Society,' vol. xviii. p. 668, it is proposed to institute a comparison between *Manduculus limatus* and the *Linyphia tenebricola* of M. Wider (Museum Senckenbergianum, B. i. p. 267. taf. 18. fig. 2); as they differ,

however, very decidedly in structure and colour, no doubt they are perfectly distinct.

182. *Pachygnatha Degeerii.*

Pachygnatha Degeerii, Sund. Vet. Acad. Handl. 1829, p. 211, & 1832, p. 259; Koch, Uebers. des Arachn. Syst. erstes Heft, p. 10; Die Arachn. B. xii. p. 143. tab. 430. fig. 1065.
Linyphia Degeerii, Walck. Hist. Nat. des Insect. Apt. t. ii. p. 269.
Theridion vernale, Hahn, Die Arachn. B. ii. p. 38. tab. 53. fig. 123.
Manduculus vernalis, Blackw. Linn. Trans. vol. xix. p. 125.

In autumn, adult males and females of this species may frequently be seen running on the ground in various parts of Lancashire and Denbighshire. A collection of spiders received from Charles C. Babington, Esq., M.A., in 1840, and another transmitted to me from Northamptonshire by the Rev. Hamlet Clark in 1842, contained specimens of *Pachygnatha Degeerii*; it is found in Scotland also, Mr. J. Hardy having taken both sexes in Berwickshire in the spring of 1849.

Family *Epëiridæ.*

Genus Epëira, Walck.

183. *Epëira quadrata.*

Epëira quadrata, Walck. Hist. Nat. des Insect. Apt. t. ii. p. 56; Sund. Vet. Acad. Handl. 1832, p. 239; Koch, Die Arachn. B. v. p. 66. tab. 162. fig. 381, 382.
Titulus 8, Lister, Hist. Animal. Angl. De Aran. p. 42. tab. 1. fig. 8.

This large and handsome *Epëira* appears to prefer wild uncultivated districts, and is not uncommon in many parts of England and Wales. It pairs in autumn, and in October the female attaches to the stems of heath or gorse a subglobose cocoon composed of coarse yellow silk of a looseish texture, measuring $\frac{7}{10}$ths of an inch in diameter, which sometimes comprises between 900 and 1000 spherical eggs of a yellow colour, agglutinated together in a lenticular form. In constructing the cocoon the female presses her spinners against the mass of eggs and attaches a compound line to it, then drawing out the line by elevating the body, she again applies the spinners to the eggs and cements the line to them in the form of a small loop; this operation is continued (the lines being united to each other when the eggs are covered) till the cocoon is completed, and, as it consists of a congeries of short silken loops, it cannot be otherwise than loose in texture.

The snare of this spider has the appearance of being constructed with geometrical precision, and is similar in design to

the nets fabricated by the *Epëiridæ* generally. It consists of an elastic spiral line, thickly studded with minute globules of liquid gum, whose circumvolutions, falling within the same plane, are crossed by radii converging towards a common centre, which is immediately surrounded by several circumvolutions of a short spiral line devoid of viscid globules, forming a station from which the toil may be superintended by its owner without the inconvenience of being entangled in it. The viscid spiral line is accommodated to the frequent and rapid changes in distance which take place among the radii when agitated by winds or other disturbing forces, by its extreme elasticity; and, in consequence of this property, insects which fly against the snare are more completely entangled than they otherwise could be without doing extensive injury to its framework. Near the net, and connected with its centre by a strong line, the spider constructs a dome-shaped cell of compact white silk which it usually occupies.

184. *Epëira apoclisa.*

Epëira apoclisa, Walck. Hist. Nat. des Insect. Apt. t. ii. p. 61; Sund. Vet. Acad. Handl. 1832, p. 243; Hahn, Die Arachn. B. ii. p. 30. tab. 48. fig. 116.
—— *virgata*, Hahn, Die Arachn. B. ii. p. 26. tab. 46. fig. 113.
—— *dumetorum*, Hahn, Die Arachn. B. ii. p. 31. tab. 48. fig. 117; Koch, Uebers. des Arachn. Syst. erstes Heft, p. 2.
—— *sericata*, Koch, Uebers. des Arachn. Syst. erstes Heft, p. 2; Die Arachn. B. xi. p. 110. tab. 385. fig. 914, 915.
—— *arundinacea*, Koch, Uebers. des Arachn. Syst. erstes Heft, p. 2; Die Arachn. B. xi. p. 109. tab. 385. fig. 913.
—— *patagiata*, Koch, Die Arachn. B. xi. p. 115. tab. 386. fig. 916–919.
Titulus 6, Lister, Hist. Animal. Angl. De Aran. p. 36. tab. 1. fig. 6.

Much confusion in the synonyma of *Epëira apoclisa* has been occasioned by some of its numerous varieties having, without sufficient investigation, been described as distinct species. The difficulties attending endeavours to reconcile conflicting opinions in such cases are well known to naturalists, and as they are unusually great in this department of zoology, I may be permitted to allege them as an excuse for any errors into which I may inadvertently have fallen in my attempt to elucidate this intricate subject. Perhaps the *Epëira foliata* and the *Epëira nauseosa* of M. Koch, 'Die Arachniden,' B. xi. pp. 119, 120, might be added to the synonyma given above, but as I entertain some doubts on this point, I have deemed it better to omit them.

Epëira apoclisa frequents gorse, heath and rank herbage growing near the margins of lakes, pools and brooks, or in other

damp situations, among which it constructs a dome-shaped cell of white silk of a compact texture. In this cell, after distributing upon its exterior surface the withered leaves of plants and closing its entrance with a tissue of silk, the spider passes the winter in a state of torpidity. During the summer and autumn the female incloses in cells of a similar construction several subglobose cocoons of yellow silk of a loose texture, measuring, on an average, $\frac{9}{20}$ths of an inch in diameter, each of which contains about 220 spherical eggs of a pale brown colour, agglutinated together in a lenticular mass. On the 18th of July, 1846, both sexes of a small insect belonging to the family *Ichneumonidæ*, the female of which is apterous, came out of a cocoon of this spider, and in 1842 I obtained specimens of the same insect from a cocoon of *Epëira umbratica*.

M. Walckenaer, in referring to an interesting fact recorded by Lister, has strangely misinterpreted the meaning of that author; he states that "Lister a observé des larves d'Ichneumon dans les nids de cette espèce" (*Epëira apoclisa*): "ces larves se sont transformées sous ses yeux et ont pris leur vol dans l'air" (Hist. Nat. des Insect. Apt. t. ii. p. 65). The source of error will be immediately perceived on perusing the following passage cited from the 'Tractatus de Araneis' of the English naturalist, page 40:—"In nido autem altero divulso triplicem, ut supra dictum est, fœtum observavi. Inter primum vero partum sex aderant parvæ Chrysalides sive Thecæ teretes, solidæ, utraque extremitate retusæ, sublividæ, id sc. genus, e quibus Muscæ tripiles, a Moufeto nostro sic dictæ, antiquis vero *Ichneumones* vespæ appellatæ, excludi solent. Ex ipsis autem Araneolis natu majoribus, qui sc. horum vermiculorum voracitatem, dum in ovo, effugerant, quotquot a me aëri expositi, protinus fila ejaculando avolavere; non injucundo sane spectaculo!"

The snares spun by *Epëira apoclisa* vary considerably in extent; upwards of 120,000 viscid globules are distributed upon the elastic spiral line in a net of large dimensions, yet, under favourable circumstances, the time required for its completion seldom exceeds forty minutes.

In the 'Annals and Magazine of Natural History,' vol. xvii. p. 79, I have asserted that the legs of all the males of this species, whether British or foreign, which I had measured, were shorter than those of the other sex; since the publication of that remark, however, I have met with several males whose legs exceeded in longitudinal extent those of the largest female in my possession, showing that this spider varies as remarkably in its proportions as it does in colour.

185. *Epëira scalaris.*

Epëira scalaris, Walck. Hist. Nat. des Insect. Apt. t. ii. p. 46; Hahn, Die Arachn. B. ii. p. 27. tab. 47. fig. 114; Blackw. Linn. Trans. vol. xix. p. 127.
—— *pyramidata,* Sund. Vet. Acad. Handl. 1832, p. 242; Koch, Uebers. des Arachn. Syst. erstes Heft, p. 2; Die Arachn. B. xi. p. 107. tab. 384. fig. 912.

I have received specimens of this showy species from Staffordshire, Shropshire, Northamptonshire, Devonshire, and Middlesex, but I have not observed it either in North Wales or Lancashire.

XXXIX.—*Contributions to the History of the Development and to the Minute Anatomy of the Infusoria.* By Prof. Stein of Tharand*.

[With a Plate.]

I. *Development of* Vorticella microstoma, *with Comparative Remarks upon the Mode of Development of the* Gregarinidæ.

In a previous essay† I have shown that all Vorticellinæ at an earlier or later stage of their development become encysted, by drawing in their ciliated disc and contracting their bodies into a ball; at the same time secreting around themselves a gelatinous mass which solidifies into a firmer elastic covering. Very commonly a *Vorticella* will become encysted while still adherent to its stalk, but in that case the stalk soon dies away and disappears, a process which is first indicated by the breaking up of its contained muscular band into single portions. More frequently, however, the action of a circlet of cilia developed close in front of the hinder extremity of the *Vorticella,* detaches it from its stalk, and it becomes encysted while freely swimming.

The *Vorticella* thus inclosed gyrates rapidly, and in exceptional cases still appears provided with its posterior circlet of cilia, though, in the majority of cases, this falls off as soon as the encysting substance is excreted.

The body of the *Vorticella* inclosed within the cyst always changes subsequently into a globular closed vesicle, which is perfectly homogeneous in its interior, incloses the unchanged band-like nucleus, and possesses besides a round cavity filled with fluid; the last however no longer changes its capacity like the contractile space of the free animal to which it corresponds, but appears always as a drop of one and the same size. In an appendix to my earlier communication I further stated, that the

* From Siebold und Kölliker's Zeitschrift, B. iii. H. 4, 1852.
† Wiegmann's Archiv, 1849.

Vorticellæ thus changed, ultimately became Acineta-like bodies, by the included vesicular Vorticella-body extending itself sometimes on one side, sometimes on all sides, and thrusting out processes of its wall, thus thinned. In this manner by one-sided extension, the form described by Ehrenberg under the name of *Podophrya fixa* as an independent species is produced, and by the universal extension, one resembling the *Actinophrys Sol* of Ehrenberg. I have since repeated this observation too often to fear that it can be erroneous. Soon after that discovery, however, I recognised the purpose of this change of the Vorticella-cysts into *Acinetæ*. The nucleus of the *Acinetæ*, or what is the same thing, the original *Vorticella*, becomes entirely metamorphosed into an actively rotating offspring; becoming contracted into an ovate body, which at its more pointed end carries a circlet of long vibrating cilia, and at its more obtuse end is perforated by a mouth which communicates with a distinct oral cavity. In the interior of this offspring we observe already a long, oval, slightly bent nucleus, and a round rhythmically contracting space*. It perfectly resembles, in fact, a young *Vorticella* which has become developed from a bud and is just ready to leave its parent. Even if the change of Vorticella-cysts into *Acinetæ* could be questioned, yet every doubt must disappear when we compare the offspring of the *Acineta* with the offspring of a *Vorticella* by gemmation, or even with a fully-developed contracted *Vorticella*, which is in the act of becoming freed from its stalk. As both the former and the latter commonly soon become fixed, and produce a stalk from their posterior extremities, so without doubt does the offspring of the *Acineta* become fixed when it has left the *Acineta*. Since the time at which these observations were first made, I have observed many hundred *Acinetæ* with rotating young, and have sometimes seen the offspring voluntarily ejected, sometimes have pressed it out of the *Acineta*. The gap, which the young tears in its passage through the wall of the *Acineta*, becomes immediately closed again. The latter goes on stretching out and retracting its radiating filaments, like feelers, and after a time produces in its interior a new nucleus for a second offspring.

Besides this propagation of *Vorticellæ* by means of *Acinetæ*

* The presence of a contractile space in Infusoria, completely excluded from the outer world, might of itself be considered sufficient to contradict the view of O. Schmidt (Handbuch d. Vergleichende Anatomie, p. 220), that the contractile spaces are vesicles opening externally at the surface of the body and intended to pump in water. I say "contractile spaces or cavities" instead of "vesicles" advisedly, because I could never see any investing membrane around the clear space, and because I know Infusorial structures with many contractile spaces which occupy no determinate locality, but move backwards and forwards.

there exists a second, which I surmised some years ago at first sight of the Vorticella-cysts, but which I was so fortunate as to discover only in the last summer holidays. An immense number of my *Vorticellæ* had become encysted, and I determined to examine them daily so as to observe once more through all its stages the metamorphosis into Acineta-forms which I had previously seen so distinctly, and then to follow the further course of the offspring of these *Acinetæ*. In order to get rid of all foreign forms of Infusoria, which might possibly have produced a deception, from my further observations, I selected, on this occasion, the mud at the bottom of the infusion, in which innumerable Vorticella-cysts lay scattered, and poured off all the water; I then rapidly evaporated the moisture contained in this mud until it was perfectly dry. The remainder just baked to its support, was, after the lapse of a day, scraped off, and fresh spring water, in which, as is well known, Infusoria are of rare occurrence, was poured over it. On re-examining the softened mud, I found my Vorticella-cysts in capital condition; every free infusorial organism had however disappeared, as might naturally be expected.

To my great astonishment, within twelve hours later I found at the surface of the infusion a considerable number of free *Vorticellæ*, all of the normal size or considerably larger, and of these a few became encysted again under my inspection.

In the course of a day all these free *Vorticellæ* had disappeared again, and they did not reappear subsequently. The considerable size and number of the *Vorticellæ*, and the fact that the infusion was covered, testify that these *Vorticellæ* had not come from without, during the twelve hours that had elapsed since the last examination; they must then have arisen from the cysts by voluntarily breaking out of them. Probably these were such *Vorticellæ* as would not have become encysted of themselves, but were constrained to do so when the evaporation of the water threatened them with death.

In the following days the alterations in the interior of the Vorticella-cysts were limited to the change of the merely spherically contracted Vorticella-body into a simple, closed, round vesicle, in which no traces of the original organization of the *Vorticella* were any longer to be detected. The contents of the cyst were now perfectly similar to those of a simple cell with sometimes coarsely granular, sometimes finely granular contents, amidst which the unchanged band-like nucleus, and a clear unchangeable space, lay imbedded. After about a week's watching for further changes, I perceived that in many cysts the included parental vesicle became sacculated-looking and uneven, and that in its interior many considerable hyaline spaces arose, which

sometimes suddenly disappeared to reappear elsewhere. I believed now that this was the commencement of the metamorphosis of the Vorticella-cysts into the Acineta-form.

But, seeking further, I came upon cysts in which one or a few of the cæcum-like projections of the parental vesicle had become so much elongated that they had broken through the covering of the cyst. Looking steadfastly at such a projection, it suddenly burst at its apex and the whole contents of the parental vesicle shot out, whilst its walls collapsed, and remained behind like an empty wrinkled bladder with a few adherent granules, within the cyst.

The free contents remained as a round, transparent, limpid drop of jelly of about the same diameter as the cyst, in which some thirty embryos, of the form of *Monas colpoda* or *Monas scintillans*, sailed about with varied and active motion as if in a little ocean.

After a time the drop of jelly became diffused, and its monadic inhabitants were scattered to the winds. More clearly and decidedly could no observation be made than that just described; yet I should have been ready to believe myself deceived by some singular accident, had I not, in the following hours which I passed with beating heart at my microscope, seen the very same process in many cysts as distinctly and decidedly as the most scrupulous criticism could require. Soon also I succeeded in bursting cysts, ripe but perfectly closed, by careful pressure, so as to see the embryos slip one after another out of the parental vesicle.

I now proceeded to examine the mode of origin of the embryos more closely, in which I succeeded all the better, as I possessed cysts of very different ages; for in a few I found the yet unchanged Vorticella-body. I observed that in cysts, whose included Vorticella-body was metamorphosed into a simple vesicle, the band-like nucleus had broken up into as many single disciform bodies as, later, embryos were to be set free. This breaking up does not take place by successive acts of division, but in the nucleus, round discs become marked off contemporaneously, at the most different points; whilst the intermediate substance of the nucleus becomes reabsorbed. The discs grow at the expense of one part of the liquefying granule-substance of the parental vesicle, whilst the other part becomes changed into the gelatinous mass, in which, afterwards, the embryos swim. The perfect embryos are oval, somewhat notched on one side, and wholly similar to the *Monas colpoda*, Ehr., or the *M. scintillans*, but quite dissimilar to a *Vorticella*. The walls of its body are as flexible as those of all ciliated Infusoria; but beside this general contractility, they unquestionably possess special motor organs;

however, on account of the minute size of the embryo, I endeavoured in vain to make these out with certainty.

Often it seemed as if the anterior end were covered with very short cilia; possibly, however, the repulsion of any fine granules which approached this part might arise from such a flabellar organ as that possessed by the monads.

After these observations, the change of Vorticella-cysts into Acineta-forms might again appear doubtful; but I was not to be led astray by these considerations, especially since the one method of propagation did not necessarily exclude the other. On the other hand, I followed out day by day the innumerable Vorticella-cysts still contained in my infusion, and, within ten days, I had the satisfaction of finding the first Acineta-forms, whose number now daily greatly increased.

The above-described formation of young within the *Acinetæ* was also frequently observed in the course of a few days more.

There can now be no difficulty, after this long series of observations so frequently repeated and confirmed, in summing up and justly expounding the whole cycle of the development of the *Vorticellæ*. From my observations it is incontestable that the nucleus—the testis according to Ehrenberg—is the true and only organ of propagation of the Infusoria, and may thence be called henceforward the germ-nucleus (Keim-kern, nucleus germinativus). A gland it is not, but a sharply defined homogeneous mass of fine granules like the nucleus in the interior of a cell, and like this, probably bounded by a membrane in its most perfect condition. That, further, the fine granules in the interior of the body of an Infusorium never perform the part of ova, is just as certain, for in the last-described mode of development of the Vorticella-cysts we have seen them one and all dissolved.

With the "testis" the "vesiculæ seminales" of Ehrenberg must equally be given up,—those clear spaces in the interior of the Infusoria, which in a note above I have stated to be nothing but spaces filled with a clear fluid.

From the "germ-nucleus" new animals proceed in two modes and of two forms. In each case the parental *Vorticella* must become invested by a capsule, and its body change into a simple globular vesicle. In each case the globular vesicle subsequently enlarges, in order, either with a change in the wall of the capsule to become a stalked or unstalked Acineta-form, or in order to burst the wall of the capsule and to set free the embryos arising from the breaking up of the germ-nucleus.

These embryos have at most the size of the very youngest *Vorticellæ* observed by Ehrenberg* and myself†, which also pre-

* Die Infusions-thiere, tab. 25. 3. 1 *a*.

† *Loc. cit.* p. 98.

sent no clear cilia, but are seated upon an excessively fine, non-contractile stalk, and which, when they become free, present exactly the same form and movements as the embryos which have proceeded from the maternal vesicle. It is therefore perhaps as good as certain, if I assume that the embryos fix themselves soon after they are born, particularly as I frequently saw such young *Vorticellæ* again in my infusion soon after the first burst cysts were observed. The production of numerous monad-like embryos then, forms unmistakeably the concluding phase in the course of development of the *Vorticellæ*, and this course would be very simple were not the *Acinetæ* interposed in the cycle.

How shall we now interpret this last phase? Two circumstances throw light upon it. First the *Acinetæ* set free their whole germ-nucleus as a ciliated individual, which, except in the want of a stalk, exhibits the whole organization of a *Vorticella*, and is in no respect different from an individual which has arisen by budding. The *Acineta*, therefore, is properly nothing else than a *Vorticella*, which out of the still, pupa-condition, has returned into active existence, but under an altered form. It sends from the surface of its body delicate radiating processes, which have independent movements, and not merely, as I previously believed, serve to keep off enemies, but also certainly take in nutriment by their surfaces, though naturally only in a fluid form. That the *Acinetæ* can be nourished from without seems to be a necessary conclusion, from the fact that I saw the germ-nucleus change into an embryo only in *Acinetæ* of a certain size;—not in the very small *Acinetæ*, which therefore must grow and be nourished from without. The production of *Vorticellæ* by the intermediation of *Acinetæ* then is perfectly equivalent to gemmation; it is a kind of internal gemmation; whilst propagation by the change of the whole inner encysted body of a *Vorticella* into numerous embryos is to be regarded as the equivalent of the sexual propagation of the higher animals. In this manner there is a sort of alternation of generations in the *Vorticellæ*, though perhaps not in so marked a form as in other Invertebrata; since each early phase of development may change into the final phase of the whole series, under peculiar conditions;—what these conditions are, however, I have not been able, as yet, clearly to determine. The embryo may, under certain circumstances, become encysted after a short period of existence, as the very small cysts, often to be observed, demonstrate. Further, a bud just freed from its parent may at once become encysted, and the stalked *Vorticellæ* are able to become so at all stages of their growth. The cysts, from the smallest to the middle-sized, appear to be able to pass into the Acineta-form only; from the

middle size upwards, they may either become *Acinetæ*, or immediately produce monad-like embryos.

We may thus ideally arrange the different stages of development through which the *Vorticellæ* pass: the largest end their lives by becoming encysted; the whole of the contents of their bodies then passes into embryos, to which the dividing germ-nucleus first gives origin.

The embryos become fixed, develope from their posterior extremity a stalk, which is at first not contractile, and gradually change their monad-like body into that of a common *Vorticella*.

As soon as this has taken place, their very much smaller size only distinguishes them from the perfect *Vorticellæ*. Even in this imperfect condition they frequently multiply by continual division and in a subordinate degree by external gemmation. [This power of multiplication in the imperfect state, however, is one of the most certain criteria that we have to do with an alternation of generations.] By degrees the generations become larger and larger; certain individuals become encysted and pass into the Acineta-form; under this form they lead an independent existence, but apply all their assimilated food to the re-formation of the germ-nucleus, which they send forth from time to time in the form of a common *Vorticella*. Finally, the last generation become encysted, not to re-awake to an independent existence, but to break up into a swarm of embryos.

At last then, after many aberrations from the right track, without however having previously *observed* wrongly, I had found the complete history of development of the *Vorticellæ*, and thereby set aside the observations of Pineau*, which, indeed, bore the stamp of improbability about them. It becomes hereby quite possible to explain the sudden appearance of *Vorticellæ* in infusions, without assuming a *generatio æquivoca*, which has been so boldly advocated lately by Dr. Gros† and Dr. Reisek‡.

For it is only necessary that a single Vorticella-cyst should get into water previously free from *Vorticellæ*, in order to people it in a very short time with troops of them. There can be no difficulty in understanding how such a cyst may be imported, if one considers that owing to their minute size, they are as readily carried about by the air, as the spores of plants. A brisk wind, ruffling the surface of some stagnant water, will as easily carry away any *Vorticellæ* there may be on its surface, as particles of

* Annales des Sciences Naturelles, 1845.

† Siebold und Kölliker's Zeitschrift, Bd. iii. p. 68. Dr. Gros did me the favour to call on me at Berlin, but did not succeed in showing any thing under the microscope by which his views might be justified.

‡ Entwickelungsgeschichte des Thieres und der Pflanzen durch Urzeugung. Berichte der Kaiserl. Akad. der Wissenschaften zu Wien, 1851.

water. The cysts may, as the experiment cited above shows, remain dry a long time, and yet their development will proceed as soon as they enter water again.

In the same way the wind may readily carry away Vorticella-systems with the dust from dried-up pools. Should any one think these suppositions too bold, let him examine the dry sand of the roof-gutters, as two years ago I did frequently in order to make my pupils acquainted with the Tardigrada. Not uncommonly, besides Tardigrada and their ova and different Rotifera, we find Vorticella-cysts which may be readily recognized if the inclosed body is yet unchanged. These cysts were either deposited in the gutters by the winds, or they are the descendants of *Vorticellæ*, which came in this way and multiplied in the rain-water collected in the gutters.

I may be allowed, in conclusion, to recur to the starting-point of my investigations upon the Infusoria; this was, my researches upon the *Gregarinæ*. The hope of finding the Infusoria not much more perfectly organized than the *Gregarinæ*, and of discovering a similar law of development for them, encouraged me to enter upon the investigation of that difficult and famous class. This hope has been fulfilled. Without at present entering into any controversy upon the organization of the Infusoria, concerning which, after the course of development we have traced, there will perhaps be no doubt, I will only point out how the law of development enunciated by me for the *Gregarinæ*, essentially harmonizes with that which governs the *Vorticellæ*.

The *Gregarinæ* become encysted for the purpose of propagation like the *Vorticellæ*, only it is always two *Gregarinæ* which become included in one capsule. The two encysted *Gregarinæ* fuse into one ball, and then a great part of the contents of their bodies becomes changed into spindle-shaped spores (the so-called *navicellæ*), whilst the remaining portion liquefies in order to contribute to the bursting of the cyst and the expulsion of the ripe spores. The encysted *Vorticella* changes also into a simple globular body, and then its germ-nucleus breaks up into numerous round discs. There is no reason why these should not be called spores. These spores however become developed into embryos in the parental cyst. Finally, the cysts burst, and, like the spores of the Gregarinidæ, they are driven forth swimming in a part of the liquefied contents of the body of the parent.

The investigations upon the *Vorticellæ* may be considered to strengthen those upon the Gregarinidæ. I bring forward the *Gregarinæ* into prominence here intentionally, because I see that lately two very estimable observers, Bruch* and Leydig†,

* Siebold und Kölliker's Zeitschrift, B. ii.

† Müller's Archiv, 1851.

endeavour to show the *Gregarinæ* to be larvæ of higher animals, and especially to connect them with encysted Nematoid worms.

For many reasons this appears to me to be a vain attempt. I will here bring forward only a few arguments. I am acquainted with *Gregarinæ* of such peculiar forms, that one requires a very strong imagination to deduce them from Nematoidea, or to suppose they can pass into these. The encysted Nematoidea are always found in the cavity of the body of insects, never in their intestinal canal, where alone encysted *Gregarinæ* are to be found.

In the few insects which contemporaneously with the *Gregarinæ* lodge encysted Nematoidea, the cyst which incloses the latter is always a well-organized structure of cells with clearly marked nuclei, upon and in which numerous tracheæ are distributed. This tissue agrees perfectly in its finer structure with the fatty mass of insects. The cyst of the Nematoidea is therefore plainly a product of the vital activity of the insect, not the exudation of the inclosed worm. The cyst of the *Gregarinæ*, on the other hand, is always an amorphous mass, and like the cyst of *Vorticellæ*, nothing but an excretion of the included *Gregarina*. If, therefore, encysted Nematoidea change into *Gregarinæ* or *vice versâ*, their cyst must undergo a metamorphosis, which perhaps no one will assume, and of which as yet no observer has seen anything. Perhaps I shall be able to find leisure for the publication of my complete researches upon the Gregarinidæ, and then the doubts opposed to my views may perhaps be resolved.

The remainder of the memoir contains descriptions of several new forms of the Vorticellinæ, principally found upon *Gammarus pulex*, *Cyclops minutus* and *Asellus*. The first—

Spirochona gemmipara, has inflexible parietes, and is closely allied to *Epistylis*.

Dendrocometes paradoxus is a very remarkable body with several radiating branched arms, almost like some *Xanthidia*. Stein supposes it, with great probability, to be the Acineta-form of *Spirochona*.

Lagenophrys is nearly allied to *Cothurnia*. Three species of it are described, from the legs of *Cyclops*, gill-laminæ of *Asellus*, and legs of *Gammarus*. One of these, *L. nassa*, is remarkable for having an armed mouth like that of *Nassula*.

The most important physiological points are: that the germ-nucleus of *Spirochona* contains a clear nucleated vesicle, but otherwise answers to that of other Vorticellinæ;—that in the oblique fission of *Lagenophrys* the anterior half of the animal goes on moving and feeding, and is seen to contain globules of nutritive matter, while the posterior half never contains any, but consists internally of a homogeneous finely granular parenchyma, in which nothing more is to be seen than a median contractile

space, and the half of the original germ-nucleus, which often remains clearly connected with the other half. "This appearance cannot be reconciled with the idea of a defined intestinal canal running circularly through the body of the *Vorticella* and beset with stalked stomach-vesicles; for since the posterior half of the body, before the commencement of the diagonal fission, showed just as numerous nutritive masses (stomach-vesicles) as the anterior, it is clear that this half must have contained a segment of the intestinal canal. By the cleft along the line of fission, the intestinal canal, like the germ-nucleus, must have been cut through in two places, and then it would have been impossible for the anterior half of the animal to go on taking nourishment; but there must have been a time of rest, during which a new uniting segment must have been developed between the two widely separated portions of the intestine."

Prof. Stein proposes the following revision of the *Vorticellinæ* (Ehr.); the Stentors to be excluded, as they are ciliated over their whole surface.

Vorticellinæ.

1. *Stalkless, free swimmers*: Trichodina, Urocentrum.
2. *Stalked; stalk contractile*: Vorticella, Carchesium, Zoothamnium.
3. *Imbedded in a common gelatinous investment*: Ophrydium.
4. *Inclosed in a cup-shaped cell*: Vaginicola, Cothurnia, Mitimnus, Lagenophrys.
5. *Provided with a non-contractile stalk*: Epistylis, Opercularia.
6. *Wholly non-contractile bodies*: Spirochona.

Of these, he says, that he has evidence that *Vorticella, Vaginicola, Cothurnia, Epistylis,* and *Opercularia* possess distinct Acineta-forms.

EXPLANATION OF PLATE XVI. D.

Fig. 1. Full-grown encysted *Vorticella microstoma*: *a,* the retracted oral circlet of cilia; *b,* the nucleus; *c,* the contractile space.

Fig. 2. A cyst separated from its stalk.

Fig. 3. The same more advanced. The nucleus has broken up into spore-like globules.

Fig. 4. The same still more developed. The mother-cyst or original body of the *Vorticella, d,* has become sacculated, and many clear spaces have appeared in it.

Fig. 5. One of the sacculations of the mother-cyst has burst through the envelope and has given exit to the gelatinous mass *e* containing the spores.

Fig. 6. Acineta-form of *Vorticella microstoma,* which has arisen from a cyst similar to fig. 2: *b,* nucleus.

Fig. 7. The stalked Acineta-form of *V. microstoma,* until now described as *Podophrys fixa*: *f,* the young *Vorticella,* the result of the transformation of the nucleus of the parent.

Fig. 8. The young, free *Vorticella*: *a, b, c,* as in fig. 1; *g,* posterior circlet of cilia.

XL.—*On some genera of the* Icacinaceæ. By John Miers, Esq., F.R.S., F.L.S.

[Continued from p. 399.]

Poraqueiba.

No botanist has ventured to assign a position in the system to this very curious genus of Aublet until very lately, when M. Tulasne has given a description of it in the 11th vol. (3rd ser.) of the 'Ann. Sc. Nat.,' where he has very correctly referred it to Mr. Bentham's tribe of the *Icacineæ*. The analysis given in plate 47 of Aublet's work, though roughly drawn, is in the main correct, and the details there shown will be more easily comprehended from the particulars I am now able to offer. The singular partitions that stand in bold relief on the inner surface of the petals, are produced by their pressure, while in bud, upon the enclosed genitals; the force of this compression is such, that a portion of their fleshy substance is forced between the interstices of the curiously formed stamens, stamping a counter mould of their shape in the raised lines and deep cells that constitute the peculiar character of the petals; the upper and transverse portions of the very elevated cruciform partitions thus produced are deep, while the lower pale is broad and hollow in its centre, forming in this manner two very deep cells in the upper, and three parallel cells in the lower moiety. This however, as might naturally be expected, proves to be a variable character, for in a new species described by M. Tulasne, the two upper cells and the intervening deep keel are deficient, owing, it would appear, to the circumstance of the anthers being only half the length of those of the other species, so that the lower moiety only of each petal presents two cavities in which the stamens are lodged in the bud. The stamens are of very singular construction, and the figure in Aublet's drawing affords a very exaggerated idea of their form. In all the preceding genera, I have described the bilobed anthers as being always distinctly 4-celled before they burst, although after dehiscence, from the evolute mode of opening, they appear as if they had been only bilocular. In *Poraqueiba*, however, this 4-celled structure is rendered manifest in a much higher degree, for the cells are here perfectly distinct, and even separated from one another for a considerable distance by the intervention of a thick 4-sided pyramidal connective, composed of coarse reddish-coloured grains: this is covered by a whitish adhering cuticle, consisting of a thicker crustaceous epidermis, and a thinner and more membranaceous inner tegument; the narrow cylindrical pollen-

cells, placed in the four salient angles of this connective, are formed by the continuation of the same cuticle, which here ceases to be adherent to the fleshy centre; the epidermis forms the anterior or external casing of the crustaceous cells, while the inner tegument constitutes the posterior lining of the cavity, which is at the same time free from the connective, although in contiguity with it, and which seems to form the receptacle for the attachment and assimilation of the pollen-grains: the pollen-cells, therefore, in reality appear to consist merely of a linear separation between the two membranes at the angles of the anther, and in all transverse sections of the same placed under the microscope, no sutural break in the continuity of the epidermis is discernible on either margin, where by its reduplication it becomes attached to the fleshy connective, nor is there any indication of a line of rupture or dehiscence. I confess therefore my inability to perceive, in any anther I have examined, the smallest appearance of bursting of the pollen-cells. M. Tulasne, on the contrary, states that they open longitudinally, by a fissure along the face of the connective; but whether sinistrorsely, or dextrorsely, or alternately so, he does not explain. In the summit of the anther, the same continuous crustaceous cuticle is extended, and drawn up into a short cylinder, or obtuse apical point, without any intervening connective, which apical point is again reflected downward along the upper portion of the anterior face of the anther, vanishing between the summits of the two anterior pollen-cells; the nature or function of this process is not apparent. In the structure of its pistillum, *Poraqueiba* resembles that of *Mappia*. Of its fruit nothing is recorded, more than that in its unripe state it is spherical, smooth, and mucronated. Although M. Tulasne has given a very elaborate description of this genus, it appears to me the following is a more correct expression of its character.

Poraqueiba, Aubl.—*Flores* perfecti. *Calyx* imo brevissime cupulatus et carnosus, limbo 5-partitus, laciniis ovatis vel subacutis, ciliatis, æstivatione quincuncialiter imbricatis, persistens. *Petala* 5, æqualia, oblonga, carnosa, marginibus summo apiceque propendenti inflexis, intus carina profunda superne longitrorsim ex altera mediana transversali decurrente et in laminam latam concavam usque ad imum continuam cruciatim disposita, modo ut in locellos quinque sic divisa sunt, nempe, 2 superiora et 3 inferiora (vel carina suprema defectu solummodo in imo 3-locellata), locellis profundis glabris, carina suprema scabrido-papillosa, in compitum fasciculo pilorum donata, pilis rigidis albidis erecto-patentibus, æstivatione valvata, sub anthesi reflexa. *Stamina* 5, cum petalis

disco hypogyno inserta, iisdem alterna, primum in locellos petalorum recondita, et circa pistillum arcte conniventia; *filamenta* carnosa, incurva, compressa, superne dilatata, apice subito attenuata; *antheræ* tetragonæ, conico-oblongæ, dorso gibbæ, basi truncatæ, et ibi versus dorsum apicifixæ, apice mucrone oblongo obtuso excentrico repente terminatæ, sub-2-lobæ, 4-loculares, loculis crustaceis, cylindricis, angustis, in angulos connectivi centralis valde crassi late discretis, 2 anticis brevioribus, propioribus, sursum attenuatis, 2 posticis summo attingentibus, incurvis, dehiscentia vix apparente (vel sec. cl. Tulasne rima longitudinali singulatim secus connectivi faciem apertis). *Ovarium* oblongum, pressione filamentorum sub-5-gonum, apice conicum, liberum, glabrum, disco parvo stipitatum, 1-loculare: *ovula* 2 juxta apicem loculi subcollateraliter superposita, podospermio carnoso suspensa. *Stylus* subbrevis, tereto-subulatus, crassiusculus, erectus. *Stigma* obsolete 3-lobum, subcavum. *Fructus* immaturus sphæricus, mucronulatus, glaber; *cætera* ignota.—Arbores *excelsæ Guianenses et Brasilienses, apice ramosæ*; folia *petiolata, alterna, ovata, acuta, integerrima, glabra*; inflorescentia *terminalis et axillaris, spicato-racemosa*, floribus *parvulis, albis, imo 2-bracteatis.*

1. *Poraqueiba Guianensis*, Aubl. Fl. Guian. i. 123. tab. 47. Barreria theobromæfolia, *Willd. Sp. Pl.* i. 1145; *Spr. Syst.* i. 583. Meisteria anonyma, *Scop. Gmel. Syst.* i. 391;—8-orgyalis, foliis oblongis, apice repente et breviter attenuatis, utrinque acutis, glaberrimis, coriaceis, reticulato-venosis, supra lucidis, subtus ferrugineo-brunneis, sub lente punctis albidis creberrimis et minutis notatis, rachi nervibusque prominulis et rufescentibus, margine undulato revolutis, petiolo brevi, canaliculato; racemo spicato axillari et terminali, floribus parvis, alternis, subglabris, albis, imo 2-bracteatis et cum pedicello brevissimo articulatis; petalis ovato-linearibus, intus 5-locellatis, staminibus æquilongis.—Guiana Gallica.—*v. s. in herb. Mus. Brit.* (*Aublet*).

This is described by Aublet as a fine tree 50 feet high with a copious branching summit: his original specimen, which exists in the British Museum, accords well with the drawing given in his work, only that the leaves being lower are somewhat larger; they answer however with his description, being $7\frac{1}{2}$ inches long, $2\frac{1}{2}$ to 3 inches broad, on a petiole of 3 lines.

2. *Poraqueiba Surinamensis*, n. sp. Poraqueiba Guianensis, *Tul. Ann. Sc. Nat.* (ser. 3) xi. 170;—foliis ovato-oblongis, apice longiuscule et repente attenuatis, glaberrimis, subtus ferrugineo-glaucis, sub lente punctis albidis creberrimis et

minutis notatis, costa nervibusque prominentibus, rufescentibus, margine undulato revolutis, petiolo longiusculo, crasso, canaliculato; racemo spicato, axillari et terminali; floribus paucis, alternis, albis, imo 2-bracteatis, et cum pedicello brevissimo articulatis, petalis ovato-linearibus, extus adpresse pubescentibus, intus 5-locellatis, staminibus æquilongis.—Guiana Batava.—*v. s. in herb. Hook. et Mus. Brit.* Surinam (*Hostman*, no. 1209).

This species appears to me distinct from the former, the leaves being much broader with a thicker and much longer petiole, and a more lengthened and more branching panicle; its leaves measure 6¾ inches long, 3½ inches broad, on a fleshy petiole ¾ inch in length; the panicle is 3¼ inches long, composed of many divaricating branchlets.

3. *Poraqueiba sericea*, Tulasne, *loc. cit.* p. 172;—excelsa, foliis latissime ellipticis vel ovato-ellipticis, basi rotundatis, vel abrupte breviterque in petiolum longum validum decurrentibus, apice mucronatis, supra glabris, subtus pilis minutissimis sericeo-pubentibus, nervis venisque prominulis; panicula racemosa, axillari, cinereo-pubescente, folio breviore, floribus approximatis, minoribus, imo bibracteolatis, et cum pedicello brevissimo articulatis, in alabastro ovato-globosis, petalis ovato-lanceolatis, imo 2-locellatis staminibus duplo longioribus, intus pilis brevibus patulis albo-lutescentibus vestita.—Brasilia æquatoriali, ad Egam Fluv. Nigri. (Pöpp. pl. no. 2597).

The leaves of this species are much larger and proportionally broader than the former, being from 6 to 10 inches long, 4 to 7 inches broad, on a petiole 1¼ to 1⅝ inch in length. The axillary panicle is from 4 to 6 inches long, and the flowers are barely 2 lines in length.

Pennantia.

The true affinity of this genus, established by Forster in 1773, has not hitherto been sufficiently well understood. Jussieu placed it among the genera of indeterminable position, hinting at the same time its probable relation with *Canarium*, a genus belonging to the *Terebinthaceæ*. Bartling considered it should be referred to the *Euphorbiaceæ*. Sprengel and Meissner held it to be an anomalous genus of the *Terebinthaceæ*. A. Richard (Voy. Astrol. 368) pronounced its station to be quite uncertain. Endlicher in his 'Prodromus' of Norfolk Island plants, placed it in *Rhamnaceæ*, a view confirmed by Lindley in his 'Introduction to Botany.' Endlicher again, in his 'Genera Plantarum,' arranged it among the doubtful genera of that family. Reisseck subsequently gave an elaborate description of its characters, when

he endeavoured to show that it was closely related to *Mauria* and *Rhus* in *Anacardiaceæ*, in which opinion he was joined by Prof. Lindley in his 'Vegetable Kingdom,' and also by Endlicher in the 3rd Supplement of his 'Genera Plantarum.' Lastly, Dr. Planchon (Hook. Icon. 778) indicated its affinity with the *Olacaceæ*. The evidence I am now able to offer will prove satisfactorily that its true position is among the *Icacinaceæ*, although it offers certain peculiarities deserving our attention. It will be seen to accord with that family in all its most essential characters; viz. in its habit, its polygamous or diœcious flowers, its small persistent 5-toothed calyx, its 5 fleshy linear petals with an inflexed apical point and valvate æstivation; its 5 hypogynous stamens alternating with these and nearly equal to them in length, with filaments induplicated in the bud; its somewhat gibbous ovarium, entirely free, which by abortion is unilocular, with ovules suspended from near the summit of the cell; its drupaceous fruit, containing an osseous indehiscent putamen, which encloses a single suspended seed, and an embryo with superior radicle, enveloped in fleshy albumen. The peculiarities just alluded to consist in the retroverted position of its ovule, as shown in the development of the fruit, in a manner similar to that seen in *Euonymus*, and which probably will be found to exist in other genera of the *Icacinaceæ*. The summit of the putamen is furnished with a kind of dorsal and apical cristate protuberance, which is prominent in the typical species, but less so in the others, and which is also seen in the putamen of *Apodytes* and *Mappia*; but below the extremity of this crest in *Pennantia*, a very distinct foramen is evident, through which the strophiole or funicular support of the suspended seed passes, and which strophiole is evidently in connexion with the raphe-like cord that is seen imbedded in the pulp, proceeding from this point, along the external ventral side of the nut, to its base. A corresponding termination of the funiculus is observable in the putamen of *Mappia*; but there no such aperture exists, although the point of suspension is at the same spot, and a similar cord is likewise seen externally, descending from that point, along the ventral face to the base, as in *Pennantia*. Reisseck describes the ovarium as being sometimes 2-locular, though generally 1-locular, and in his analytical sections it is represented as having only a single cell. Endlicher, however, in his 'Prodr. Fl. Norf.' had long before stated it to be 3-locular, in the species from Norfolk Island, a fact repeated in his 'Genera Plantarum.' A. Cunningham, quoting the generic character upon Endlicher's authority, also describes the ovarium of the New Zealand species to be 3-locular (Ann. Nat. Hist. iii. 248). Endlicher, however, in the 3rd Supplement of the 'Genera Plantarum,' evidently upon the

testimony of Reisseck, renounces his former statement, and describes the ovarium as being unilocular, a discrepancy manifestly attributable to different views, entertained at different times, in regard to its affinity, it having been referred at one period to *Rhamnaceæ*, at another to *Anacardiaceæ*: it is not recorded that such views originated in any careful observations upon its internal structure. Reisseck in addition states, that its ovarium (either 1- or 2-celled) has a single ovule suspended by a long filiform and erect placenta, which rises from the bottom of the cell to near the summit, as in *Rhus*; but I have not been able to observe any such feature, and the fact that the seed is suspended from a strophiole which passes through a foramen near the apex of the nut, and which is connected with the cord that descends hence externally to the calyx, militates strongly against the probability of the existence of any such internal connexion of the podosperm with the base of the cavity. In *Pennantia* we see the existence of a testa and integument furnished with a dorsal raphe and a nearly basal chalaza, which I have not been able to detect in *Mappia*; but in the latter case, these features were not distinguishable, on account of the seeds having been long desiccated, the albumen having become black, the integuments much decayed, and adhering to the cavity of the nut. The seed of *Pennantia* differs from that of *Mappia* in having a much smaller and almost terete embryo, placed in the upper portion of the albumen, in which respect it agrees with *Apodytes*, while in *Mappia* the cotyledons are of considerable size and foliaceous, as in *Celastrus*. It should also be remarked, that in the New Zealand and Norfolk Island species, the stigma is described as being large, pulviniform and sessile, exactly as it has erroneously been figured in *Stemonurus*; but, as in that genus, this will be seen to occur here alone in the ovuligerous flowers, and then only after the ovarium has attained a considerable increment and advance towards maturity. I have met with fertile female flowers only in the New Holland species, and there three very distinct and equal styles exist; the ovarium is deeply grooved into three corresponding lobes, each lobe being distinctly 1-celled, as I have found to occur in *Stemonurus*. Only one of the ovules in one of these cells becomes perfected, so that the fruit is only 1-celled and 1-seeded, but partial deviations from this rule sometimes occur. The ripe fruit of this same species is an oval drupe, surmounted by a sessile 3-lobed discoid plate, similar to that observed in the two other species of *Pennantia*, and in every species of *Stemonurus*, in *Sarcostigma* and in *Discophora*. As I have traced in *Pennantia Cunninghami* the existence of several distinct styles or stigmata, and the subsequent conversion of these organs into sessile discoid processes, we may safely infer that it

is common to all the species of the several genera above mentioned; that after impregnation the styles become flattened and expanded, until they form a sessile fleshy disc, more or less lobed, upon the summit of the fruit: I feel convinced that Bauer, when he made his drawing of *P. Endlicheri*, sketched the figure of the ovarium after this transformation had taken place. The fact of the existence of three distinct styles and three separate cells in the ovarium, does not militate against the ordinary character of the *Icacinaceæ*, as demonstrated by the structure already shown to exist in the genera previously described; for though the ovarium is there uniformly 1-celled, I have all along endeavoured to prove that such is the case only by abortion, and that normally, in all those instances, it is in reality 3- or 5-celled. My object in constantly maintaining that fact, has been to show the fundamental difference in normal structure that exists between the *Icacinaceæ* and the *Olacaceæ*. In regard to the circumstance of the presence of three distinct styles in *Pennantia*, we must remember the very analogous structure in several genera of the section last described; for instance in *Apodytes*, *Rhaphiostylis* and *Leretia*; but in those cases, two of these styles are nearly obsolete, as are also two of the corresponding cells of the ovarium: in all these instances, the normal axis is in the centre of these cells, although two of them be only rudimentary; for where the ovarium is apparently only 1-celled, the ovules are invariably suspended near the apex of the cavity, upon the side of the abortive cells and of the two rudimentary styles. It is desirable to keep these facts in view when we come to speak of *Stemonurus* and *Sarcostigma*.

Among the numerous specimens in Sir Wm. Hooker's herbarium of *Pennantia corymbosa* from New Zealand, I have not been able to meet with a single ovarium that shows any trace of an ovule; this, in every flower I have examined, exhibits itself in the form of a terete, narrow, conical, or subulate style-like column, rising out of a pentangular hypogynous disc, and surmounted by a distinctly clavate and undivided stigma. On making sections both longitudinally and transversely, there appears nothing but a homogeneous fleshy mass: had I not encountered the necessary elements in the New Holland species, we should have had no evidence to guide us to the real structure. I have already described the pistillum, existing in that species, as appearing like three subulate processes, conjoined for two-thirds of their length, the upper parts free and erect, the united portions forming three distinct cells; one of these cells only appears ovuligerous, the ovulary body occupying the whole space of the cell and suspended by a short cord from the summit; but on account of the great tenuity of the walls of these cells, the

soft texture of the ovule, and the minuteness of the parts, it is difficult to extract it entire; it bears at first sight the appearance of a single ovule, but from the overlapping of the visible edges, it would seem as if composed of two ovules pressed together: as I failed to separate them, owing to the reasons just mentioned, I cannot state with certainty that this body consists of two ovules. The analogy of this structure with what I have observed in *Stemonurus* and other genera will be found most complete, and it offers additional testimony to support what I have urged, in regard to the normal structure of the whole family.

I have alluded to the fact of the unusual occurrence of a raphe-like cord, imbedded in the pulp of the fruit, originating in the calyx, ascending along the external ventral side of the nut, and attaching itself to the strophiole of the seed which protrudes through the foramen just below the apex: this cord consists of two distinct threads, and apparently results from the extended remains of the two abortive cells, or it may consist merely of the nourishing fibres, become thickened, that constituted originally the axile column of the united carpels: its marked appearance in such a position is certainly an occurrence worthy of notice. I shall be able to show, that under certain circumstances, this external cord disappears, and the phænomena then observed all tend to confirm the inferences just drawn in regard to the true nature of this process.

Another fact remains to be mentioned that offers very instructive evidence. The two species of *Pennantia* from New Zealand and from Norfolk Island, both produce a drupe containing a solitary, hard, three-cornered nut, as has already been described: though very different in dimensions, their structure is precisely alike. The fruit of *P. Cunninghami,* on the contrary, encloses a thin, soft and coriaceous putamen, which is oval, 1-celled, and contains a single seed, resembling the two preceding species in structure and attachment; but the external cord is adherent, and cannot be detached from it without rupture. I have found, however, one instance in which the putamen is distinctly 2-celled, the cells being separated by a thin dissepiment, and each filled by a single seed, suspended in the usual manner from the summit of a thick internal cord, which originating in the base, proceeds close to the walls of the putamen, attached to one side of the dissepiment, reaches the summit of the cells, where it throws out two strophiolar processes, one into each cavity, from which the seeds are respectively suspended: it need hardly be suggested that the cord in question must be the elongated relic of the abortive third cell. This is an instructive fact, showing how necessary it is to trace the growth of seeds through all their successive stages from their origin, in order to understand their

true structure and development. The circumstances observed in *Pennantia Cunninghami*, of possessing three distinct styles and cells in the fertile ovarium (a character which, for aught we know to the contrary, may be common to all the species), and of having also a drupe containing an oval coriaceous putamen, might induce some botanists to place this species in a genus distinct from the other hard-nutted species, but it appears to me that such differences are not sufficient to authorize their generic separation; should it be thought otherwise, it might bear the name of the section in which it is here placed. The following generic character is almost wholly based upon my own observations.

Pennantia, Forst.—Flores polygamo-dioici. *Calyx* parvus, crasso-discoideus, obsolete 5-dentatus, immutatus et persistens. *Petala* 5, oblonga, carnosula, glabra, æstivatione valvata, apice inflexa, sub anthesi patentia. *Stamina* 5, petalis alterna, iisdem longiora, ad marginem disci extus affixa; *filamenta* filiformia, æstivatione induplicata, in anthesi patentia: *antheræ* oblongæ, 2-lobæ, e basi ad medium 2-fidæ, lobis connectivo angustissimo et tenuissimo nexis, sejunctis, parallelis, subrugosis, apice basique interdum glandulis piliformibus donatis, singulatim 2-locellatis, valvulis e marginibus contiguis utrinque evolutis et hinc rima longitudinali late hiantibus: in floribus fœmineis polline destitutis. *Pollen* sub-4-gonum, rarius 3-gonum. *Ovarium* brevissimum, conicum, glabrum, disco pentagono suffultum; in floribus masculis teres, subulatum, carnosum, effœtum, stigmate capitato terminatum: in floribus fœmineis conicum, profunde 3-sulcatum, textura tenui, 3-loculare, loculis 2 (rarius 1) effœtis: *ovulum* unicum (vel potius gemellum ?) loculum implens, oblongum, funiculo sub-brevi ex apice suspensum. *Styli* 3, loculis ovarii continui, iis dimidio breviores, erecti, subulati, *stigmata* totidem compressa, emarginato-spathulata, stylisque demum in discum sessilem epigynum fructus coronantem mutata. *Drupa* baccata, ovalis, monopyrena. *Putamen* osseum vel coriaceum, ovatum vel inæqualiter 3-gonum, apice ex angulo dorsali cristatum, summo faciei ventralis angustioris subcavum, et hinc foramine parvulo perforatum, 1-loculare, loculo callo 2-lobo infra foramen notato, monospermum. *Semen* medio strophiolæ suspensum, loculo conforme; *strophiola* crassa, foramen percurrens, et ad apicem chordæ conspicuæ per faciem externam putaminis ad torum continuæ adnexa: *testa* membranacea; *raphe* a strophiola apicali usque ad *chalazam* basalem latere dorsali producta. *Albumen* carnosum, dorso propter raphen immersum sulcatum: *embryo* isto dimidio brevior, apice inclusus, subteres, *cotyledonibus* ovatis, carnosulis, parvulis, *radicula* supera

æquilongis.—Arbores *proceres* in Nova Hollandia et insulis Novæ Zeelandiæ Norfolkiæque *crescentes, glaberrimi*; folia *elliptica, coriacea, nitentia, integra, vel interdum grosse subdentata, petiolata*: corymbi *terminales, rarius axillares, multiflori*; flores *parvi, ad pedicellos bracteatos articulati.*

§ 1. Eupennantia. Putamen osseum, trigonum, sub apicem foramine conspicuo perforatum.

1. *Pennantia corymbosa,* Forst. Prodr. 396; A. Cunningham in Ann. Nat. Hist. iii. 248; Reisseck, Linnæa, xvi. 339. tab. 12; —arbor 6-orgyalis, ramis albo-punctatis; foliis cuneato-oblongis vel subellipticis, acutis, extra medium inæqualiter grosseque dentatis, interdum integris, emarginatis, coriaceis, glaberrimis, supra lucidis; panicula ampla, corymbosa, terminali, diffusa, puberula, multiflora, alabastris ellipsoideis; petalis patentibus, filamentis filiformibus, capillaceis, antheris oblongis; drupa atro-purpurea.—Nova Zeelandia.—*v. s. in herb. Hook.*

This species is so fully described and figured as above quoted, that it is not necessary to enter into any details. I may however remark that its leaves are much smaller, and far less coriaceous than the other two species, and being for the most part coarsely toothed, it bears a very different aspect. The upper leaves, as in the specimens in Sir Wm. Hooker's herbarium, scarcely exceed 1 or $1\frac{1}{2}$ inch in length; but Reisseck states that the lower leaves are usually 2 or 3 inches long, as they are represented in his drawing. The nut is double the size of that of the next species*.

2. *Pennantia Endlicheri,* Reisseck, Linnæa, xiii. 341. tab. 13. P. corymbosa, *Endl. Prodr. Fl. Norf.* 80; *Iconog.* tab. 121; *Ferd. Bauer, Ill. Pl. Norf.* tab. 165;—ramulis teretibus, fistulosis, cortice viridi, lenticellis pallide fuscis maculato; foliis elliptico-oblongis, aut obovatis, obtusis, retusisve, basi cuneatis, coriaceis, glaberrimis, supra nitentibus, subtus pallidioribus, nervis venisque prominulis, margine revolutis; panicula corymbosa, ampla, terminali, diffusa, multiflora, glabriuscula, floribus hermaphroditis cum pedicellis bracteatis pubescentibus articulatis, paucis masculis intermixtis, alabastris globoso-ovoideis glabris, petalis luteo-viridibus, subreflexis, filamentis subulato-filiformibus, antheris ovoideis: drupa minori, ovata, atro-purpurea, stigmate coronata.—In Insula Norfolkiæ.—*v. s. in herb. Hook.* (A. Cunn.).

It is worthy of notice that the delineations and analytical de-

* Analytical details only, of the floral and carpological structure observed in this species, will be appended to the drawing of *P. Endlicheri.*

tails of this species given in the 'Linnæa,' though marked on the plate as having been drawn by Reisseck, form a perfect facsimile of the plate in the 'Iconographia' above-quoted, which is a production of the pencil of Ferd. Bauer, and published four years previously; but in that of the 'Linnæa' several figures are added which do not exist in the other, giving sections of the ovarium, which are manifestly founded on error; for the ovule is there represented as being suspended at its apex from a long podosperm, springing from the base of the cell, as in *Rhus*. Much faith is to be placed on the drawings of Bauer, who has the reputation of having always correctly depicted what he saw, and it is therefore necessary to make a remark in regard to the figures in question, in which the ovarium is represented as bearing no style, but crowned with a pulvinate, 3-lobed, sessile stigma: this is so different from what I have observed in the young flowers of the species from New Holland, that I suspect the drawing was made from flowers advanced in age, where, by the growth of the ovarium, the styles had become obliterated, and the stigmata rendered sessile. Cunningham's specimens of the same plant are fructiferous only, and the berries are all crowned with a sessile stigma, so that I am unable to solve the doubt as to the fact in question, otherwise than from analogy, as shown in the preceding pages.

The lower leaves of this species are described by Endlicher as being $7\frac{1}{2}$ inches long and 5 inches broad, but in the specimens in Sir Wm. Hooker's herbarium the upper leaves are $4\frac{1}{2}$ inches long, $2\frac{1}{2}$ inches broad, narrowed to the base into a somewhat slender petiole $\frac{3}{4}$ inch in length; they are shining, very thick and coriaceous: the corymb has its branches spreading broadly at nearly right angles, and is about 3 inches long. The fruit is an oval drupe, much smaller than the other two species, being only 4 lines long, and encloses a 3-gonous nut 3 lines in length*.

§ 2. Dermatocarpus. Putamen ovatum coriaceum.

3. *Pennantia Cunninghami*, n. sp.;—omnino glaberrima, ramulis teretibus, fistulosis, lenticellis pallidis verruculosis, foliis oblongis, utrinque acutis, apice acuminatis et mucronulatis, crasso-coriaceis, supra lucidis, nervis venisque immersis, subtus pallidioribus, nervis rubentibus prominulis, integris, margine subrevoluto undulatis, minutissime pellucido-punctulatis, petiolo canaliculato: paniculis corymbosis, terminalibus, et axillaribus, glabris, multifloris, folio dimidio brevioribus: alabastris ovoideo-oblongis, ♂ staminibus demum exsertis, filamentis brevio-

* This plant, with carpological details, will be shown in plate 11 of the 'Contributions to Botany,' &c.

ribus, induplicatis; antheris lineari-oblongis, rugosis, glanduloso-pilosulis; drupa olivæformi.—New South Wales, County of Camden.—(*v. s. in herb. Hook.—spec. in flor.* Illawarra, M'Arthur—*sp. in fruct.* Five Islands district, A. Cunningham.)

These specimens may be said to be from the same locality, for Illawarra, though on the mainland, is in the Five Islands district, and opposite to those islands in lat. S. 34° 50′, a little to the south of Port Jackson. From Cunningham's journal, he does not appear to have visited them, and all his specimens collected about Illawarra are stated as from "Five Islands." The leaves are larger than in the two foregoing species, are shining, smooth and coriaceous, $5\frac{1}{2}$ inches long, $2\frac{1}{2}$ inches broad, on a petiole $\frac{5}{8}$ of an inch in length; those of the specimen from Illawarra are smaller, and evidently much younger; the panicle is $3\frac{1}{2}$ inches long, with its branches less spreading *.

XLI.—*Note upon the Male of the* Argonaut *and the* Hectocotylus. By Dr. Henry Müller of Wurzburg †.

Delle Chiaje ‡ and Cuvier § were the first to describe the *Hectocotylus* of the Argonaut (*Trichocephalus acetabularis*), and the *Hectocotylus* of *Octopus granulosus,* which were considered by them to be worms parasitic upon the Cephalopods. Later, Costa || asserted the *Hectocotylus* of the Argonaut to be the spermatophore of this creature.

Kölliker ¶ soon afterwards discovered a third *Hectocotylus* upon *Tremoctopus violaceus* (D. Ch.), and was led to regard the three *Hectocotyli* as the males of the Argonaut, *Octopus* and *Tremoctopus,* which had in vain been previously sought for.

Guided by the observations of Madame Power**, Kölliker supposed that the male Argonauts (the *Hectocotyli*) were developed like vermiform embryos, in separate groups of ova.

Last year M. Verany†† described a species of *Octopus* (*O. carena*) which had the right arm of the third pair more developed than the rest, and provided with an oval globe at its free extremity.

* A representation of this species, with analytical details of its floral and carpological structure, will be given in plate 12 of the 'Contributions to Botany,' &c.

† From the Annales des Sciences Naturelles, vol. xvi. No. 3.

‡ Memorie, vol. ii. p. 223.

§ Annales des Sciences Naturelles, 1819.

|| Annales des Sciences Nat. 1837.

¶ Bericht von der zootomischen Anstalt zu Wurzburg, 1849.

** Annales des Sciences Nat. 1841.

†† Mollusques Mediterranéens, Gènes, 1851.

M. Filippi having seen this *Octopus*, made out that this abnormal arm was the *Hectocotylus octopodis* of Cuvier, upon which Verany thought himself justified in concluding that the *Hectocotylus octopodis* was nothing more than the deciduous arm of the *Octopus*, carrying male organs. As for the *Hectocotyli* of the Argonaut, and of the *Tremoctopus*, Verany is of opinion that they cannot be arms: so that the question of the nature of the *Hectocotyli* has become more unsatisfactory than ever.

In studying the *Hectocotyli* at Messina in the course of last year, I discovered the true male Argonaut, and I had the satisfaction of being able to trace the connexion which exists between this Argonaut, and the *Hectocotylus Argonautæ*. This last is nothing else than a part of the Argonaut which is developed within a coloured sac, which occupies the place of the third arm of the left side. All the male Argonauts which I have seen are small (not beyond an inch in total length), and shell-less; in the latter respect resembling the females of this size.

Their superior arms are not expanded, but are pointed: the sac of which I have just spoken incloses, without exception, a *single Hectocotylus*, whose enlarged portion is contained within the pedicle and attached at its base, whilst the rest of the body is free and coiled up towards the side on which the suckers are placed.

As soon as the sac is opened, or becomes cleft by the movements of the *Hectocotylus*, this latter curves back, and at the same time the sac inverts itself (*se retourne*), and becomes the coloured capsule, described by Kölliker in the back of the detached *Hectocotylus*.

The Argonaut itself contains a very large testis, whose situation and structure are exactly the same as in the ordinary *Octopoda*, and which incloses spermatozoa in different degrees of development.

The excretory canal of this testis could not be demonstrated in specimens preserved in spirits, which at present are the only ones which have been examined with regard to this point.

However, it can scarcely be questioned that it debouches into the *Hectocotylus*, since this always contains in the silvery sac described by Kölliker, spermatozoa, which often fill also the canal which proceeds from it (*ductus deferens*, Kölliker) as far as the end of the filiform appendage, which very probably performs the part of a penis.

It is then proved, that the *Hectocotylus* is formed upon a male Argonaut, and is nothing else in short than an arm metamorphosed irregularly. This arm or the *Hectocotylus* is detached when the seminal fluid formed in the true testicle of the Argonaut has been deposited in it, and from this moment it enjoys

an apparently independent life. It lives on the female Argonauts, fecundates them by a true copulation, as I have observed in the *Hectocotylus Tremoctopodis,* and by this circumstance, by its movements, by a kind of circulation, and by the long duration of its life after its detachment, it resembles a true male animal.

However, it cannot be regarded as an independent animal, having no organs of digestion, and not being the place in which the semen is formed, but only an organ for its transport.

On the other hand, it is evident that the *Hectocotylus* is not an ordinary spermatophore, since these, according to the investigations of Milne-Edwards, have not the least trace of organization, while the *Hectocotyli* possess muscles, nerves, ganglia (the *Hectocotylus* possesses a chain of ganglia in the axis of its body in the middle of the muscular tube), vessels, chromatophores, &c.

The *Hectocotylus* of the Argonaut is then the arm of a male Argonaut metamorphosed for the purpose of carrying the semen, and therewith impregnating the female; an arm endowed with so high a degree of independence that it truly deserves Cuvier's phrase, "un ver vraiment extraordinaire."

I shall shortly publish in MM. Siebold and Kölliker's 'Zeitschrift für Zoologie' a more elaborate memoir upon this subject.

XLII.—*On the Ergot of Rye,* Sclerotium Clavus, *D.C.* By M. L. R. Tulasne*.

Since botanists have been agreed in regarding the ergot of Grasses as a vegetable production (*Sclerotii spec.,* D.C.; *Spermædia,* Fries), almost all have distinguished in it two things: one a fungoid, homogeneous and solid mass (*Sclerotium,* D.C.; *Nosocarya,* Fée), and the other a filamentous and sporiferous portion, especially abundant towards the summit of the Ergot (*Sphacelia,* Lév., Fée; *Ergotætia,* Quekett). It is imagined that this latter chiefly constitutes the parasitic fungus, and the body of the Ergot is regarded as a monstrosity of the ovule (Léveillé†), a pathological production (Phœbus, Mougeot, &c.), or an hypertrophied seed (Fée), no further inquiry having been made as to its real

* From the Comptes Rendus, December 8, 1851. Communicated by Arthur Henfrey, F.L.S.

† Vide Ann. des Sc. Nat. 2nd Ser. xx. 218. Although M. Léveillé misunderstood the nature of the Ergot of the Grasses, his opinion that the *Sclerotia* are "fungi arrested in their development, or rather a condensed *mycelium,* the nature of which is to provide for the preservation of the species" (*loc. cit.* 216), acquires a further degree of certainty from the facts mentioned in this note.

nature and destination. Yet its enormous volume in comparison with the *Sphacelium* deserved more attention, and should have led to a suspicion that the latter did not play the most important part. The discovery of a sporiferous portion of the Ergot was undoubtedly a considerable step forwards in the knowledge of this singular vegetable, the toxicological and medicinal virtues of which give it a double interest; but it does not appear at present that this discovery sufficiently authorized the removal of the Ergot of Grasses from the number of the *Sclerotia*, among which M. DeCandolle properly placed it. In fact, the Ergot of Rye, which I take as a type, is formed, like the majority of the *Sclerotia*, of a very dense tissue of polygonal cells, intimately connected together, and turgid with an oleaginous liquid. Moreover, an attentive study of its development shows that it grows exactly in the manner of a *Sclerotium*, that is to say, in the midst of a filamentous tissue which invades the flower and in particular the ovary. One circumstance however is peculiar to it, namely that it rudely resembles the seed of Rye. The reason of this is, that it is developed in the unfecundated ovule of this plant; for although the integuments of the ovule are greatly dilated and rendered unrecognizable by the entophyte, they become enlarged without entirely diverging from the form which they would have possessed had they been destined to protect a true seed; and in this respect they resemble ovaries of Wheat in which the *Tilletia Caries* has taken the place of the seed. That which was at first called the *sphacelium* (Léveillé), then the *sacculus* (Fée), in the Ergot, is nothing more than the accumulation toward the summit (and most frequently both around and within the still subsisting extremity of the ovary) of the filaments of the *mycelium*, of which this *sphacelium* forms an integrant part, and of the *conidia* * (*sporidia* of authors) which originate from it; but as the filaments and the *conidia* are found more or less abundantly on all points of the Ergot, the supposed *sphacelium* is merely an acrogenous production, as was imagined, and it would be wrong to attribute precise limits to it.

If there were nothing more in the Ergot of Rye, than a *Sclerotium* with the *mycelium* which has produced it and the *conidia*, scattered over the filaments of the latter, there would be no necessity to make these last two into a particular entity, or to give them a collective and special name (*Sphacelia*, Lév., Fée); for, even combined with the *Sclerotium* itself (*pseudostroma*, Fée), they do not constitute a complete plant (the *Sphacelidium* of Fée), and taken together, are properly speaking only organs of vegetation. The fungus which arises from all this arrangement,

* Vide, with regard to this word, my note on the Reproductive Apparatus in the Fungi, Comptes Rendus, March 31, 1851. (Annals of Nat. Hist. 2nd Ser. vol. viii. p. 114.)

which must be regarded as the term of the whole, is an elegant *Sphæria*, and very probably the same which has received from M. Fries the name of *Cordyliceps* purpurea*. This plant was first described at the commencement of the present century by Schumacher, who stated that he found it upon the seeds of diseased Cereals. It has been observed anew recently on the *Sclerotium Clavus* produced on *Bromus sylvaticus* (M. Roussel), on *Arundo Calamagrostis*, and on an undetermined Grass (MM. Petit and Bamberger, quoted by M. Desmazières); finally, according to M. Mérat, who thought that it was to be regarded as a new species of *Onygena* (*Onygena cæspitosa* seu affinis, Mér. *MS.* in suopte herb.), M. Duméril has met with it on the Ergot of Rye. Nevertheless it does not appear that the origin of this *Cordyliceps* has opened the eyes of botanists to the nature of the Ergot of the Grasses; and although this mode of origin had hitherto been regarded as merely accidental, I was desirous of ascertaining by direct experiment that the final product of the Ergot of Rye was really such as the preceding observations indicated. With this intent therefore I this summer planted a certain number which began to vegetate nearly two months ago, and I now possess some which bear several examples of *Cordyliceps*, which I have seen produced, and traced day by day in their development.

If, after these explanations, other proofs of the true nature of the Ergot of Rye should be judged necessary, I would cite as a term of comparison the *Cordyliceps typhina*, Fries, the *stroma* of which proceeds from a filamentous *mycelium*, altogether analogous to that of *Sclerotium Clavus*, D.C., and which in like manner becomes covered with innumerable acrogenous *conidia* before giving birth to aggregated *perithecia*, differing in no respect in their intimate structure from those of *Cordyliceps purpurea*, Fries.

The conclusion from all this is, that the Ergot of the Grasses, if it be subject, like other plants, to the influence of cosmical circumstances, is not, as M. Fries imagined, incapable of propagating by seeds, since it possesses at least two kinds: viz. 1. the *conidia*, which precede and accompany the development of the *Sclerotium*, and which I have several times seen germinate and become elongated into filaments, like the *conidia* of the *Erysiphes* (fertilizing organs and spores, Léveillé†), or like the spores pro-

* M. Fries usually writes, doubtless by abbreviation, *Cordyceps*; but both are hybrid words, for which it will be perhaps convenient to substitute *Claviceps*, which preserves their signification.

† Vide Ann. des Sc. Nat. 3rd Ser. xv. 119, 120 & 178. M. Léveillé seems to have mistaken the value which I have attributed to the reproductive cellules which arise in strings from the *mycelium* of the *Erysiphes*; for I have hitherto regarded them only as *conidia* (see my note on the Reproductive Apparatus of Fungi cited above).

perly so called of the Fungi; and 2. the spores of the *Cordyliceps,* in which probably resides the most perfect faculty of propagation, and a great portion of which are only ripened and disseminated about the period of the flowering of the Rye*.

An examination which I have made of the Ergot of *Scirpus Bæothryon* and *Heleocharis multicaulis,* and of their *conidia,* leads me to think, contrary to the common opinion, that the Ergot of the Grasses and that of the Cyperaceæ do not belong to an identical species of vegetable; it will also be necessary to investigate whether it is true that they are always identical in themselves, or whether each may not embrace several distinct specific entities.

BIBLIOGRAPHICAL NOTICES.

Class Book of Botany; being an Introduction to the study of the Vegetable Kingdom. By J. H. Balfour, M.D. &c., and Professor of Botany in the University of Edinburgh. Part I. *Structural and Morphological Botany.* 8vo. Pp. 357. Edinburgh, Black, 1852.

Notices of introductory works on botany cannot fail to be very uniform in character, for all such books having the same object in view, we have little more to do than to state our opinion of the success with which the several treatises have been prepared. New matter is not to be expected in them, at least such is the case with those published in Britain; for some continental botanists seem to forget that an Introduction is intended to teach beginners of the study, not to convey information, however valuable and interesting, to those who have made much advance, or are even masters in the science.

The work before us makes no pretensions to be different in character from other similar books; but it does pretend, and we think justly, to be not only the last of them, but also one of the best books to place in the hands of a student. From the Professor's peculiar success as a teacher, and the especial attention which he is well known to pay to the preparation of his lectures by accumulating every fact as it is made known in the literature of the day, we certainly expected that such would prove to be the character of his work. We have carefully looked over the book, but find it impossible to select any part which would by transference to our pages convey a good idea of the work itself; for the publisher has so liberally supplied the author with woodcuts, that without introducing them also we should not do it justice. These cuts are more than a thousand in number in 360 pages of type, and they are such as to replace as far it can be done the illustrations with which a lecturer teaches his class.

* In like manner we see the Maples already clothed with young leaves in spring, when the *Rhytisma cerinum* casts its linear spores to the winds.

We have not now before us the whole of the projected work, as this Part is occupied with structural and morphological botany exclusively.

The brief recapitulation inserted at the end of each section will be of peculiar value to the student.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

November 26, 1850.—R. H. Solly, Esq., F.R.S., in the Chair.

ON THE HABITS OF HELIX LACTEA. BY J. S. GASKOIN, F.Z.S. ETC.

As all facts relating to animated nature, elucidating the habits and powers of living creatures, however low their station in the scale of creation, must be interesting and instructive, I do not hesitate to place before the Zoological Society a few observations I have been enabled to make on some individuals of the genus *Helix*. In April 1849, I purchased four or five specimens of *Helix lactea* (African), and placed them in water to be cleaned for my cabinet; one, some hour or two after immersion, resuscitated, and escaped from the vessel. These specimens were selected from a great many others, all of which had been together in a dry dusty drawer in the dealer's shop for more than two years, and had been imported by a merchant of Mogadore, in whose possession they had remained, in a similar condition, for a still longer period. The test of submersion in water was afterwards practised on the whole stock of the dealer, and none reviving, it was concluded all were dead. I placed the living stranger under a large glass bell on a tub of earth, and it lived well on cucumbers and the outside leaves of cabbages, &c., quite alone, until the end of the following October, when I discovered about thirty minute black helices, not the twenty-fifth of an inch in diameter, crawling on the inside of the glass, on the mould, &c. At first I had doubts as to their origin, but with growth the markings and form of my African captive being approached, the point was no longer to be mistaken. Some of these are now (October 30, 1850) nearly as large as the parent, which measures $1\frac{4}{8}$ inch across the long diameter of the aperture, although the lip in no instance has begun to evert; thus twelve months have not sufficed to attain the adult state. Now as the Helix is known to be bi-sexual, and not hermaphrodite, it follows that in this instance impregnation or conception must have occurred prior to the capture of the animal, after which it fell into a state of suspended animation, and is traced to have remained so for more than four years; and we know nothing of the time it may have remained in the hands of the native gatherer before he took his collectings to the town dealer for sale; and I see no reason why, vitality having been latent for so lengthened a period, it might not have continued so almost indefinitely, and on the restoration of animation all the functions of the system resumed at once

their natural powers: and what is most remarkable, utero-gestation resumed its process to accomplish the period, from the time it had been arrested, as though no circumstance had suspended the operation, and the time destined by Nature for its completion. I conclude the Helix to be insusceptible of prospective fecundation, that is, one communication of the sexes being sufficient for more than one conception, or there would probably before this time have been another brood of young ones, as the parent is still living and flourishing.

To render this paper more perfect, I will add a few other examples relating to the same subject. Dr. Baird has recorded in the 'Annals of Natural History' for July last, the circumstance of an Egyptian Helix, the "Snail of the Desert," the *Helix maculosa* of De Férussac, having remained gummed to a tablet in a show-case of the British Museum during four years, when the existence of an apparently recently formed epiphragm being observed, it was removed from the tablet and placed in tepid water, and in a short time crawled away. It fed on cabbage-leaf, and began very soon the completion of a repair of the aperture of its shell, which had been broken prior to its capture, the suspension of animation having arrested the execution of the work. It resuscitated on the 15th of March last, but has shown neither signs nor result of fecundation, although still living.

I am indebted to Mr. T. Vernon Wollaston (who interspersed his entomological pursuits, during a two seasons' residence on the island, with a no less fruitful and valuable research in terrestrial conchology) for several species of living mollusks, principally Helices, indigenous to Madeira and its adjacent rocks: all these had lain in a box in dry canvas bags for a year and a half, and had been restored to vitality by placing them in water. They were put under glass shades, on flower-pots filled with mould, or in large glass cases, and all fed well. Three individuals of the *Helix undata* of Lowe, within forty hours, deposited more than two hundred small, white, semipellucid pearl-like eggs, which, on exposure to the air, soon became of an opake white; not in a covering, nor agglutinated, but together, loose in the earth. One portion or nidus, about sixty in number, I immediately restored to their situation, about three-quarters of an inch below the surface, covering them with mould, hoping therefrom to learn the period of incubation. The parents burrowed their heads and bodies into the earth, remaining in that position some twenty or thirty hours, or forced themselves, shell and all, below the turf, and so deposited their ova. Other species have also produced eggs.

Curious and instructive as these facts may be, perhaps the continuance of the vital principle in mollusks removed from their native element may seem still more so, especially in the case of a bivalve, which has so much less perfectly the power of excluding the influence of atmospheric air on its animal substance; yet the latency of animation is a quality obviously necessary for the inhabitants of ponds and other shallows, which of course at certain seasons are liable to be dried, or the existence of the species would soon become extinct. An Unio, which lives in ponds, and much resembles the British species, *Unio tumidus* of Retzius, but is somewhat higher and shorter, was

packed up by the Rev. Robert King, on the 26th of January 1849, at Wide Bay in Australia, having been enclosed in a dry drawer for 231 days, but was first submitted to the test of water, when its valves opened and it was alive. On its arrival at Southampton about the latter end of June 1850, 498 days after it had been taken from the pond, Mr. Newnham, to whom it was consigned, in consequence of what Mr. King had written, a second time placed it in water, when it expanded its valves and was living. It was then forwarded, *inter alia*, to the British Museum, and is restored to its element with full vital powers, in the care of Dr. Baird of that establishment, to whom I am indebted for this relation.

I have now living, the *Helix Fraseri*, Australia; *H. lactea*, Africa; *H. turricula*, Madeira; *H. laciniosa*, Madeira; *H. undata*, Madeira; *H. tectiformis*, Madeira; and the *Carocolla Wollastoni*, Madeira.

On new Birds in the Collection at Knowsley. By Mr. Louis Fraser. In a Letter to the Secretary.

Knowsley Hall, November 11, 1850.

Sir,—Having received a notification, through Lord Derby, of my appointment to the Consulship at Whydah, my stay in England is necessarily drawing to a close. I have endeavoured to meet your wishes by forwarding a few brief descriptions from novelties contained in this extraordinary Collection, and with his lordship's permission I forward the original drawings made by Mr. Wolf, who has been engaged here for some considerable time.

I have the honour to be, Sir,
Your obedient servant,
Louis Fraser.

D. W. Mitchell, Esq., Sec. Zool. Soc. Lond.

The first specimen to which I would wish to draw the attention of the Society is a Parrakeet of large size, which I propose calling

Palæornis Derbianus.

Forehead, round the nostrils, a small stripe from the nostrils to the eyes, and a broad moustache, black; head, towards the bill and round the eyes, green, passing into a light violet-blue on the occiput and ear-coverts; the remaining upper parts of the bird, the thighs, vent and under tail-coverts green, being more yellow on the back of the neck and centre of the wings; the shafts of the two centre tail-feathers dark purplish brown, with their webs, towards the apex, blue; from the hinder part of the ears, down the side of the neck, and behind the moustache, runs a narrow line of light rose-coloured purple, which colour extends over the whole under surface; the under side of the tail-feathers greyish yellow; bill black; feet the usual parrakeet colour; eyes pale straw-colour.

Length from base of beak to tip of tail,	20 inches.
Curve of upper mandible	$1\frac{5}{8}$,,
Wing	$8\frac{3}{8}$,,
Tail	$10\frac{1}{2}$,,

Hab. ——?

This specimen has been many years in this collection, and I have chosen for its specific name that of its noble owner. The species is easily distinguished from all the other members of the genus by its larger size, and the colours of the bill, head and breast.

The next bird is a second species of the same genus.

Palæornis erythrogenys.

Male: Green; the back, between the shoulders, mealy; cheeks and ear-coverts red, which colour passes on to the hind head, where it meets, in a more rosy tint; moustache black; the tips of the two centre tail-feathers blue; upper mandible red, lower black; legs grey.

Length from base of bill to end of tail,	$15\frac{1}{2}$	inches.
Curve of upper mandible	$1\frac{3}{8}$	,,
Wing.........................	$7\frac{1}{2}$	,,
Tail	9	,,

Hab. ——?

This bird is nearly allied to *P. longicauda*, Bodd., but is larger; the tint on the cheeks is different; the belly and under wing-coverts are green; the primaries are not edged with blue; the centre tail-feathers are only blue for half their length; and the rump is green.

Crax Alberti.

Male: Black, with blue gloss; the lower part of the belly, vent, under tail-coverts, and the tips of the tail-feathers, white; cere beautiful azure blue; bill yellowish green horn-colour; eyes dark hazel.

Female: Red-brown; head and crest-feathers barred alternately with black and white; rump and tail barred with brown, yellow and dark brown; bill black horn-colour; eyes dark hazel.

Hab. ——?

The pair of birds from which the accompanying descriptions and figures were taken, are now living in his lordship's aviaries. A new and beautiful species of a limited family like the Curassows must be looked upon as a valuable addition to our stock of ornithological acquaintances, and deserving of a distinguished cognomen. I therefore propose to name it after Her Most Gracious Majesty's illustrious consort, His Royal Highness Prince Albert, forming at the same time a companion to my *Goura Victoriæ*.

The male is at once distinguished from its nearest ally (*Crax Alector*, Linn.) by the blue cere: the female differs from all the specimens I have had an opportunity of examining by the broad bands on the tail.

Penelope niger.

Male: Black, with blue, and in some lights green reflections; bill, throat (nearly naked), tarsi and feet red.

Female: Brown, with green reflections, each feather having several bars of rust-colour, the colour and markings being less distinct on the under surface of the bird.

Length from base of beak to tip of tail,	23 inches.
Gape	$1\frac{1}{2}$,,
Wing	9 ,,
Tail	$11\frac{1}{2}$,,
Tarsi	$2\frac{3}{4}$,,

Hab. ——?

There are three specimens in this museum, two males and one female; one of the males lived in the aviaries for many years.

BOTANICAL SOCIETY OF EDINBURGH.

Thursday, 11th March, 1852.—Professor Balfour, Vice-President, in the Chair.

The following papers were read:—

1. "Remarks on the Growth of the Jalap Plant (*Exogonium Purga*), and of the Scammony Plant (*Convolvulus Scammonia*), in the open ground of the Botanic Garden," by Prof. Balfour. After alluding to the cultivation of the Jalap and Scammony plants in Britain, Dr. Balfour read some remarks by Mr. M'Nab on their mode of cultivation in the open air in the Botanic Garden.

2. "On the Rate of Growth of the Bamboo (*Bambusa arundinacea*) in the Botanic Garden," by Mr. M'Nab. The statement of the growth of a bamboo stem in the Palm-house of the Royal Botanic Garden, from the time it first showed itself above the soil (15th July, 1851) till the 31st of August, being a period of the year when artificial heat was almost entirely withheld, showed that on each day it increased in length by quantities varying from $2\frac{1}{2}$ to $5\frac{3}{4}$ inches.

3. "Notice of a case of extensive Poisoning by one of the Cape Iridaceæ," by Allan Dalyell, F.R.S.E., late Lieutenant 27th Regiment. Communicated by Dr. Douglas Maclagan. The perusal of an interesting paper on Colchicum by Dr. J. M. Maclagan, reminded me that I possessed the sketch of a Cape plant with whose poisonous properties I accidentally became acquainted. During 1841,—I write from memory, when forming part of the demonstrative force ordered to the Orange River—on one occasion after a march, arduous from its length, but especially distressing from excessive drought, a halt was made on the banks of the Little Fish River, near the village of Somerset. That evening, eighty of the baggage and artillery oxen were reported dead, and next morning forty more were found poisoned, having eaten the flowers of a small iris-like plant which grew in abundance around the encampment.

During the following year, in the "Tarka," I had many opportunities of renewing acquaintance with the same plant,—not, however, under similar circumstances; it is only when oxen are so far exhausted by over-driving, as to lose their discriminative instinct in the hurry of impetuous hunger, that poisoning follows its presence in their grazing grounds.

The nature of the locality where it grew, at the "Tarka," closely resembled that at Somerset; the flats above the bed of the "Swart

kie" at the former, as those of the Fish River at the latter place, produced it in abundance. The plant was always regarded as an enemy, but I never saw it eaten by cattle except in the instance which I have detailed.

It is not possible for me to state the precise time in which death followed from eating it. I think, however, I may venture to offer from three to nine hours as the most probable time. Long before the heat of day had operated on the dead, the dilated eyes and the frothy nostrils and mouths of the poisoned cattle were commented upon, whilst we scrambled over them at morning parade, as indicative of a more suffering death than such faithful companions of our toils deserved. Symptoms of gastritis were marked by their previous moanings: further than this, however, it is not in my power to speak with certainty.

I am indebted to the kindness of Prof. Balfour for the probable botanical name of the plant. A rough sketch taken at the "Tarka" has been identified as that of *Vieusseuxia tripetaloides,* one of the Iridaceæ, an order numerously represented in Southern Africa.

It only remains for me to notice, that from the solidity of the ground it is next to impossible that any of the roots could have been got up; poisoning was, therefore, due to the flowers, stem and leaves. I have also every reason to believe that every one of the oxen which had eaten of the plant died.

Dr. Balfour stated that he had determined the plant as far as possible from the drawing by Mr. Dalyell, and that he considered it to be *Vieusseuxia tripetaloides,* D.C., *Iris tripetala,* Thunberg, and *Moræa tripetala,* Ker. He also stated that several of the Cape Iridaceæ seemed to be poisonous, and referred especially to *Homeria collina* as noticed in Dr. Pappe's 'Prodromus of the Cape Medical Flora.' "I introduce this plant," says Dr. Pappe, "(which is known to almost every child in the colony as the Cape Tulip), not for its therapeutical use, but for its noxious properties. The poisonous quality of its rhizomes appears to have been known to some extent years ago, but judging from the rapidity with which death ensued in a recent case, when they had been eaten by mistake, it must be of a very poisonous kind. To Dr. Laing, Police Surgeon of Cape Town, I am indebted for the particulars of a most melancholy case of poisoning caused by this plant. A Malay woman, somewhat advanced in years, with her three grandchildren respectively of the ages of twelve, eight, and six, partook on 18th September 1850 of a supper consisting of coffee, fish and rice, and ate along with this a small basinful of the bulbs of *Homeria collina.* The exact quantity which each ate is not well known. They appear to have supped between 7 and 8, and retired to bed at 9 o'clock, apparently in good health.

"About one in the morning the old woman awoke with severe nausea followed by vomiting, and found the children similarly affected. She endeavoured to call for assistance, but found herself too weak to leave her bed; and when at five o'clock assistance arrived, the eldest girl was found moribund, and expired almost immediately. The little boy of eight years died an hour afterwards; and the youngest child

was found in a state of collapse, almost insensible, with cold extremities, pulse scarcely 50 and irregular, pupils much dilated. The symptoms of the grandmother were nearly similar, but in a lesser degree, accompanied by constant efforts at vomiting. By using diffusible stimulants, she and this child eventually recovered."

4. "Notice of the Number of known Fossil Plants at different Epochs, and of the Natural Orders to which they are referred," by Prof. Balfour. After alluding to the division of the Fossil Epochs as given by Brongniart, viz. into the Reigns of Acrogens, of Gymnosperms, and of Angiosperms, Dr. Balfour proceeded to give an analysis of the orders of Fossil Plants as given by Unger. The following general tabular view was compiled from Unger's work :—

	Genera.	Species.
DICOTYLEDONOUS FOSSIL PLANTS.		
Thalamifloræ	24	84
Calycifloræ	49	169
Corollifloræ	30	73
Monochlamydeæ Angiospermeæ	48	221
,, Gymnospermeæ	56	363
MONOCOTYLEDONOUS FOSSIL PLANTS.		
Dictyogenæ	2	5
Petaloideæ	36	125
Glumaceæ	5	12
ACOTYLEDONOUS FOSSIL PLANTS	152	1172
UNCERTAIN FOSSIL PLANTS	38	167

These plants are arranged in different strata as follows :—

Cambrian, Silurian, Devonian, and Old Red Sandstone (older and middle Palæozoic)	73
Carboniferous	683
Lower Red Sandstone (Permian)	76
Magnesian Limestone	21
Upper New Red Sandstone	38
Shell Limestone	7
Variegated Marls	70
Lias	126
Upper, Middle, and Lower Oolite (Jurassic)	168
Wealden (Wealden Clay, Hastings Sandstone, Pembroke Beds)	61
Chalk (Greensand)	122
Tertiary Eocene	414
,, Miocene	496
,, Pliocene	35
Diluvian	31
Fossil species	2421

After alluding to Sir Charles Lyell's observations on the Flora of the Carboniferous Epoch, as given in his late introductory discourse to the Geological Society, Dr. Balfour referred to Raulin's account

of the Flora of the Tertiary Epoch in Central Europe. By this it appears that—

1. The Eocene Flora is composed of 127 species, of which 115 belong to Algæ, Characeæ, Ulvaceæ, Palmæ, Naiadaceæ, Malvaceæ, Sapindaceæ, Proteaceæ, Papilionaceæ, and Cupressineæ.

2. Miocene Flora, 130 species, of which 69 are Algæ, Palmæ, Naiadaceæ, Apocynaceæ, Aceraceæ, Plataneæ, Lemnaceæ, Papilionaceæ, Quercineæ, Myricaceæ, and Abietineæ.

3. Pliocene Flora, 259 species, of which 222 are Algæ, Fungi, Mosses, Ferns, Palms, Ericaceæ, Ilicineæ, Aceraceæ, Celtideæ, Rhamneæ, Papilionaceæ, Juglandaceæ, Salicineæ, Quercineæ, Betulineæ, Taxineæ, Cupressineæ, and Abietineæ.

The Eocene species are allied to genera now found in intertropical regions, India, Asiatic Islands, and Australia; some are peculiar to the Mediterranean region. The Aquatics, which form nearly one-third of the Flora, are related to genera now found in temperate regions of Europe, and in North America.

The Miocene species belong to genera found now in India, Tropical America, and other intertropical regions, but of which the greater portion inhabit subtropical and temperate regions. Some are genera found in India, Japan, and north of Africa.

The climate of Europe during the Tertiary Epoch appears to have been becoming more and more temperate by a gradual process of cooling.

ROYAL INSTITUTION.

Upon Animal Individuality. By Thomas H. Huxley, F.R.S., Assistant-Surgeon R.N.

The Lecturer first briefly described the structure of the Diphydæ and Physophoridæ—pointing out the general conformity of these animals with the common *Hydra.*

They differ, however, in this important respect; that the body in which the eggs are developed is in *Hydra* a simple process; while in the Diphydæ and Physophoridæ the corresponding body presents every degree of complication from this form to that of a free-swimming, independent "Medusa."

Still more striking phænomena were shown to be exhibited by the *Salpæ.* In this genus each species has two forms. In the example chosen these forms were the *S. democratica* and the *S. mucronata*; the former is solitary and never produces ova, but developes a peculiar process, the "gemmiferous tube;" upon which and from which the associated *Salpæ mucronatæ* are formed by budding.

Each of these carries a single ovum, from which the first form is again developed.

The *Salpa mucronata,* which is thus produced from the *Salpa democratica,* is just as highly organized as the latter. It has as complete a circulatory, nervous, and digestive apparatus, and moves about and feeds as actively; no one unacquainted with its history

would dream of its being other than a distinct individual animal, and for such it has hitherto passed.

But the *Salpa mucronata* has exactly the same relation to the *S. democratica* that the free-medusiform egg-producing body of *Physalia* or *Velella* has to the *Physalia* or *Velella*; and this free-medusiform body is homologous with the fixed medusiform body of *Diphyes*; which again is homologous with the semi-medusiform, fixed body of a *Tubularia* and with the egg-producing process of the *Hydra*.

Now as all these bodies are homologous with one another, one of two conclusions is possible: either, considering the *Salpa mucronata* to be an individual, we are logically led to look upon the egg-producing process of *Hydra* as an individual also; which seems absurd: or starting with the assumption that the egg-producing process of *Hydra* is a mere organ, we arrive at the conclusion that the *Salpa mucronata* is a mere organ also; which appears equally startling.

The whole question appears to turn upon the meaning of the word "individual."

This word the Lecturer endeavoured to show always means, merely, "a single thing of a given kind."

There are, however, several kinds of Individuality.

First, there is what may be called *arbitrary* individuality, which depends wholly upon our way of regarding a thing, and is therefore merely temporary: such is the individuality of a landscape, or of a period of time; a century for instance.

Secondly, there is an individuality which depends upon something else than our will or caprice; this *something* is a fact or law of co-existence which cannot be materially altered without destroying the individuality in question.

Thus a Crystal is an individual thing in virtue of its form, hardness, transparency, and other co-existent qualities; pound it into powder, destroy the co-existence of these qualities, and it loses its individuality.

Thirdly, there is a kind of individuality which is constituted and defined by a fact or law of succession. Phænomena which occur in a definite cycle are considered as one in consequence of the law which connects them.

As a simple instance we may take the individuality of the beat of a pendulum. An individual beat is the sum of the successive places of the bob of the pendulum, as it passes from a state of rest to a state of rest again.

Such is the individuality of living, organized beings. Every organized being *has* been formless and will again be formless; the individual animal or plant is the *sum* of the incessant changes which succeed one another between these two periods of rest.

The individual animal is one beat of the pendulum of life, birth and death are the two points of rest, and the vital force is like the velocity of the pendulum, a constantly varying quantity between these two zero points. The different forms which an animal may assume correspond with the successive places of the pendulum.

In man himself, the individual, zoologically speaking, is not a state of man at any particular moment as infant, child, youth or man; but the sum of all these, with the implied fact of their definite succession.

In this case, and in most of the higher animals, the forms or states of the individual are not naturally separated from one another; they pass into one another, undistinguishably.

Among other animals, however, nature draws lines of demarcation between the different forms; thus, among insects the individual takes three forms, the caterpillar, the chrysalis, and the butterfly. These do not pass into one another insensibly, but are separated by apparently sudden changes; each change being accompanied by a separation of the individual into two parts. One part is left behind and dies, it receives the name of a skin or cast; the other part continues the existence of the individual under a new form.

The whole process is called Ecdysis: it is a case of what might be termed *concentric* fission.

The peculiarity of this mode of fission is—that of the two portions into which the individual becomes divided at each moult, one is unable to maintain an independent existence and therefore ceases to be of any importance; while the other continues to carry on all the functions of animal life and to represent in itself the whole individuality of the animal. From this circumstance there is no objection to any independent form being taken for, and spoken of, as the whole individual, among the higher animals.

But among the lower animals the mode of representation of the individual is different, and any independent form ceases, in many cases, to represent the whole individual; these two modes, however, pass into one another insensibly.

The best illustration of this fact may be taken from the development of the Echinoderms, as it has been made known by the brilliant discoveries of Prof. Müller.

The *Echinus lividus* stands in the same relation to its *Pluteus*, as a butterfly to its caterpillar; in the course of development only a slight ecdysis takes place, the skin of the *Pluteus* becoming for the most part converted into the skin of the *Echinus*.

But in *Asterias*, the *Bipinnaria* which corresponds with the *Pluteus*, gives up only a portion of its integument to the developed *Asterias*; the remaining and far larger portion lives for a time after its separation as an independent form.

The *Bipinnaria* and the Starfish are as much forms of the same individual as are the *Pluteus* and *Echinus*, or the caterpillar and butterfly; but here the development of one form is not necessarily followed by the destruction of the other, and the individual is, for a time at any rate, represented by two co-existing forms.

This temporary co-existence of two forms of the individual might become permanent, if the *Asterias*, instead of carrying off the intestinal canal of the *Bipinnaria*, developed one of its own; and this is exactly what takes place in the *Gyrodactylus*, whose singular development has been described by Von Siebold.

But the case of the *Gyrodactylus* affords us an easy transition to that of the Trematoda, the Aphides, and the Salpæ, in which the mutual independence of the forms of the individual is carried to its greatest extent; so that even on anatomical grounds it is demonstrable that the difference between the so-called "skin" of the caterpillar, the free *Bipinnaria*, and the *Salpa democratica*, is not in kind, but merely in degree.

Each represents a *form* of the individual; the amount of independent existence of which a form is capable, cannot affect its homology as such.

The Lecturer then proceeded to point out that the doctrine of the "Alternation of Generations," and all theories connected with it, rest upon the tacit or avowed assumption, "*that whatever animal form has an independent existence is an individual animal*,"—a doctrine which, he endeavoured to show, must, if carried out, inevitably lead to absurdities and contradictions, as indeed Dr. Carpenter has already pointed out.

There is no such thing as a true case of "Alternation of Generations" in the animal kingdom; there is only an alternation of true generation with the totally distinct process of Gemmation or Fission.

It is indeed maintained that the latter processes are equivalent to the former; that the result of Gemmation as much constitutes an individual, as the result of true Generation; but in that case the tentacles of a Hydra, the gemmiferous tube of a Salpa, nay, the legs of a Centipede or Lobster, must be called individuals.

And if it be said that the bud must have in addition the power of existing independently, to constitute an individual; there is the case of the male Argonaut, which has been just shown by H. Müller to have the power of detaching one of its arms (a result of gemmation), which then leads a separate existence as the *Hectocotylus*.

Without a misuse of words, however, no one would call this a separate individual.

In conclusion the Lecturer stated his own views thus:

The *individual animal* is the sum of the phænomena presented by a single life; in other words, it is, all those animal forms which proceed from a single egg, taken together.

The individual is represented in very various modes in the Animal Kingdom: these modes pass in nature insensibly one into the other; but for the purposes of clear comprehension they may be thus distinguished and tabulated.

Representation of the Individual.

I. By Successive Inseparable Forms.

Ascaris. A. Forms little different = Growth.
Triton. B. Forms markedly different = Metamorphosis.

II. By Successive Separable Forms.

1. *Earlier Forms not Independent.*

Cockroach. A. Forms little different = Growth with Ecdysis.

Beetle. B. Forms markedly different = Metamorphosis with Ecdysis.

2. *Earlier Forms partially Independent.*

Starfish.

III. By Successive and Co-existent Separable Forms.

a. External Gemmation.	*b. Internal Gemmation.*
A. Forms little different.	All the Forms produce Eggs.
Nais.	*Gyrodactylus?*
Hydra.	
B. Forms markedly different.	Last Forms only produce Eggs.

*** Last Forms produced.

Generally:

Medusa. *Fluke.*

Locally:

Salpa. *Aphis.*

These various modes of Representation of the Individual are ultimate facts. One is neither more nor less wonderful or explicable than another; any theory which pretends to account for the Successive and Co-existent forms of the Aphis-individual, must also account for the Successive forms of the Beetle-individual or of the Horse-individual—since they are phænomena of essentially the same nature.

When the forms of the individual are independent, it becomes desirable to have some special name by which we may denote them, so as to avoid the incessant ambiguity of the two senses of the word 'individual.' For these forms the Lecturer some time ago proposed the name 'Zooid.' Thus the Salpa-individual is represented by two Zooids; the Fluke by three; the Aphis by nine or eleven, &c.

The use of this term is of course a mere matter of convenience, and has nothing to do with the question of Individuality itself.

MISCELLANEOUS.

THE COLLARED SNAKE, COLUBER NATRIX.

This species, which is generally called the *Common Snake*, appears to have a much more limited distribution in the British Islands than is generally supposed,—much more so than the common adder, the viviparous lizard, the blind worm, or the frog and toad.

I am assured on the following authorities, that it is not found in the undermentioned districts—viz. the western part of South Wales, by Mr. Fortune, by my son-in-law Mr. Stokes, and several other naturalists and sportsmen; in Norfolk, by Mr. Edwards; in Northumberland, by Capt. Widdrington, R.N.; in the Eastern Border, viz.

not in North Durham nor in Berwickshire, by Dr. George Johnston; the latter further observes, "I have heard that it has been taken in the Isle of Arran, and indeed some one told me that it was common there. I myself never saw it in any part of Scotland I have visited."

This snake has an extended geographical distribution; it is found in the southernmost part of Europe, and as far north as Denmark and Sweden: more than one continental species of reptiles are found in the latter country that are not found in the British Islands.

The *adder* is very common in South Wales, where it grows to a large size; it is also common and large in the northern parts of Scotland.

I should be very much obliged to any naturalist who would give me further information on this subject.—J. E. Gray.

Note on the most important Result of the Sericicultural Experiments made with the assistance of M. Eugène Robert at the Experimental Silkworm Establishment at Sainte-Tulle. By M. Guérin-Méneville.

In this note M. Guérin-Méneville lays before his readers an official document certifying the success of some experiments made by him on a large scale, for the purpose of disinfecting the silkworm establishments in which the disease called *Muscardine* is prevalent. It is well known that this malady is a plague to the cultivators of silkworms in all countries;—in France it causes annually a loss of millions.

For a period of five years, M. Guérin has gone every spring into the south of France to one of the principal raisers of silkworms, M. Eugène Robert, well known for his zeal in behalf of this branch of French agriculture.

It will be seen from the report of which the following is an abstract, and which was made in obedience to a decree of the Prefect of the department of the Basses-Alpes, that something useful has resulted from these labours. The commission of inquiry consisted of the Subprefect of the *arrondissement* in which the experiments took place, and of five other gentlemen, principally connected with the silk manufacture.

The report states that the Commissioners proceeded on the 16th June, 1851, to ascertain the state of the silkworm establishments of Sainte-Tulle and Rousset, and the results of the processes employed by MM. Guérin and Robert with the view of arresting the ravages of the muscardine. This disease only becomes a source of serious prejudice to the cultivator, when, having appeared in an establishment, it leaves behind it the germs of an infection which becomes more and more fatal every year, and often compels the cultivator to renounce his business. M. Guérin's process accordingly consists in a fumigation, the nature of which will be hereafter revealed, which interrupts the transmission of the muscardine from one year to another,—penetrating into every corner and fissure of an infected apartment, destroying the vitality of the *Botrytis* which contains the germ of the epidemic and reducing it to an inert state, and this at a cost and with a facility which renders it within reach of the means of the most

humble cultivator. M. Guérin also proposes to act directly by the same process on the egg of the silkworm; but his experiments on this object were not sufficiently completed to be brought under the notice of the Commission.

At Sainte-Tulle, the establishment of M. E. Robert, the crop amounted to 381 k. 4 h., and did not present any appearance of muscardine. Up to this period the establishment had every year been more or less ravaged by the disease.

At the establishment of M. J. Coutet, which is precisely opposite that of M. E. Robert, one-fourth of the silkworms had been thrown out of the window, and during the few minutes which the Commission spent near the frames, its members collected several of the animals seized by the contagion. The return would be nothing, or very miserable.

The vast establishment of Madame Robert, situated about 100 paces from that of M. E. Robert, was closed, but the heaps of diseased worms which were found thrown out, sufficiently indicated the state of the crop. Madame Robert, from 22 ounces (550 gr.) of eggs, has only obtained a return of from 25 to 30 kilogr. of cocoons. The Commission was unable to see the other establishments at Sainte-Tulle, but it appears that their state was very similar.

At Rousset, at the establishment of MM. Eugène Robert and Co., the crops from 1845 to 1850 had diminished, owing to the ravages of the muscardine, from 500 kilogr. of cocoons for 500 gr. of eggs, to 106 kilogr. in 1850. The net produce of this year is 456 kilogr. 5 hect.—difference 350 kilogr. 5 hect. Other establishments in the neighbourhood in which the process of M. Guérin-Méneville had not been applied presented the same results as those at Sainte-Tulle.

In presence of these facts the Commission would not hesitate to pronounce the object attained and the plague of epidemic muscardine vanquished, if a wise reserve did not render it advisable to multiply experiments before proclaiming this great service rendered to agriculture. It expresses a wish therefore that a new inquiry should take place in 1852, and that the commission to be appointed should visit the establishments at Sainte-Tulle and Rousset not only at the period of gathering, but during the whole course of the cultivation.

In conclusion, the Commission recommends the laborious and useful researches of M. Guérin-Méneville to the notice of the Government.—*Revue Zoologique.*

On the Petrifaction of Organized Bodies (especially Shells) in the existing Seas. By M. Marcel de Serres.

I believe it was first proved by me that, like the seeds of *Chara* in the lakes of Scotland, shells are even now becoming petrified in the bosom of the Mediterranean. It is only necessary for this purpose that the water, whether fresh or salt, should contain a sufficient quantity of calcareous salts, to take the place of those which composed, during life, the shells of Mollusca, the solid tubes of Annelida, the stony habitations of polypes, or lastly woods and seeds.

Repose does not appear to be necessary for this substitution, for it takes place in the midst of the violent agitations of the sea; but there

is another condition which singularly favours the transformation of an organic substance more or less charged with animal into purely inorganic matter,—this is the presence of some support; metallic bodies in particular exercise the greatest influence on this phænomenon.

Thus a vase of copper, which I have laid before the Academy of Sciences of Montpelier, after remaining for some time in the bosom of the Mediterranean, was thrown out upon the shore, covered with a very hard calcareous incrustation of several centimetres in thickness. This incrustation had attached to it several rolled pebbles, as well as fragments of various sizes of a considerable number of shells. Some of these fragments are of sufficient size to enable us to recognize the species to which they belong. Amongst them it is easy to distinguish the *Cardium tuberculatum, Venus gallina, Cerithium vulgatum,* and some portions of an *Ostrea*; all species now existing in the Mediterranean. These shells, completely petrified, have been converted into carbonate of lime, at the same time that they have lost the animal matter which they originally contained. Their hardness and solidity are greater than those of some petrified species from tertiary formations.

After the completion of the calcareous deposit which covers the surface of this vase, individuals of *Serpula echinata,* Lam., and *Flustra depressa,* Lamx., had attached themselves to the solid mass, where they continued to live until the period of the vase being thrown up on the shores of the Mediterranean.

We must therefore distinguish two epochs in the circumstances which had taken place on the surface of this vase from the time of its falling into the sea, to that of its rejection on the shore. The first and most ancient is that of the formation of the incrustations and of the petrifaction of the shells. The second, and more recent, is that in which the marine animals attached and developed themselves on the surface of these incrustations, the materials of which had passed into the solid state.

In the collection of M. Doumet, Mayor of Cette, there exists an anchor which exhibits the same circumstances, and which is also covered with a layer of solid calcareous matter. This contains specimens of *Pecten, Cardium,* and *Ostrea* completely petrified, and the hardness of which is equal to that of fossil species from secondary formations. On the surface of the deposit in which the anchor is imbedded, there are *Anomiæ* and *Serpulæ* which were living when the anchor was got out of the sea; these present no trace of alteration.

Judging from the size, the form, and the mode of fabrication of this anchor, it would appear to belong to the period when Saint Louis embarked for the Holy Land, and with the more reason from its having been found close to the *grau* of Aiguesmortes. If this be the case, much time cannot be necessary for the production of these phænomena.

There are also in M. Doumet's collection several pieces of wood drawn from the Mediterranean, which present the same facts, and point to two different epochs. These fragments, covered with incrustations and petrified shells, prove that whenever organized bodies are

placed in analogous circumstances, they pass into a stony state and become petrified like the greater part of the organic remains of geological periods, which have been immersed in salt or fresh water.

Lastly, I have observed in the same collection, urns and amphoræ of Roman origin, which, when drawn from the Mediterranean, presented incrustations of various thicknesses, but of considerable solidity. These stony deposits, like those already mentioned, contained, imbedded in their substance, petrified shells. Their surfaces also were covered with polypes, *Serpulæ,* and *Anomiæ,* which, not being in the least altered, must have been living when these vases were taken out of the sea. It is to be presumed that similar facts are much more common than I had supposed, when commencing my researches on the petrifaction of the shells of our epoch. It is therefore to be hoped that naturalists living in sea-ports or near large collections will devote their attention to these phænomena, which possess the greatest interest, as establishing an evident relation between what is now taking place in the world and the events which occurred in a world when no human being was an eye-witness.

An objection has been raised to my observations which does not appear to me to be well-founded, considering the facts referred to in my previous researches. It has been supposed that the shell-grit which is constantly in course of formation in the present seas, and the petrifactions which are found in it, are deposits of the tertiary epoch ; but to render this a serious objection, it would be necessary that the organized bodies thrown out upon their shores by the Mediterranean, and probably by other seas, should belong to that geological period. Now, every one knows that all the organized bodies which I have noticed in my previous researches, as well as those which I have just mentioned in this note, belong to existing species, and have never been met with, at least up to the present time, in the tertiary formations,—so, as long as they shall not be found there, they must be considered as belonging to the present period, because we observe them in nature.

Some persons, admitting that these facts prove incontestably that shells become petrified in our existing seas, have supposed that they must be regarded as fossils, because they have been transformed into new inorganic elements, and become petrified in the true acceptation of this term. Those who have raised this objection have added that it was instilled into them by Cuvier, who considered petrified bodies as true fossils.

It may be observed, that the state, in which fossil organized bodies are presented to us, is of no use in the determination of the period in which they were interred, and can teach us nothing relative to their date. In fact, a great many species of the tertiary formations still retain their shell, and are less altered than those which I have laid before the Academy, for they are not petrified at all. Therefore we must only regard as fossils those organic remains which are found in geological deposits. This mode of thinking has led me to designate the *subfossil* organized bodies by the name of *humatiles* ; they belong principally to the alluvial and diluvial deposits.—*Bibliothèque Universelle,* March 1852.

Additions and Corrections to Mr. Davidson's Paper on the Classification of the Brachiopoda.

P. 364, insert "3*. *Ter. septigera,* Lovén, 1846; Index Moll. Scand. p. 29.—*Hab.* Finmark."

P. 371, Mr. Forbes's name "*depressa*" must be adopted for the *Morrisia,* because the name *seminulum* was *intended* by Philippi for an *Argiope,* although his figure may have been taken from more than one shell.

P. 373, line 13, for "only one" read "only one *septum.*"

P. 373. 45. *Argiope Forbesii.* From examination of specimens in Mr. Hanley's cabinet, it appears that this species is the *Neapolitana* of Scacchi, and in part, at least, the *seminulum* of Philippi. Scacchi's name has priority of both the others.

P. 374, line 8, for bra*n*chial read *brachial*!

P. 375, line 25, for "an exception" read "*no* exception."

METEOROLOGICAL OBSERVATIONS FOR APRIL 1852.

Chiswick.—April 1. Overcast and cold: fine: clear and frosty. 2. Cold dry haze: clear and frosty. 3. Slight fog: fine: clear. 4. Slight haze: overcast: clear. 5, 6. Fine. 7. Cloudy. 8. Cold and dry: clear. 9. Very fine. 10. Clear: hazy. 11. Foggy: very fine. 12. Hazy: clear at night. 13. Hazy: very fine: clear. 14. Dry haze: fine, with very dry air: clear. 15. Foggy: slight haze. 16. Cloudy and cold. 17. Clear and fine. 18. Cloudy and cold. 19. Clear and cold: cloudy: clear, with sharp frost at night. 20. Clear: very fine: sharp frost at night. 21. Clear, with excessively dry air. 22. Foggy: fine: clear. 23. Fine, with hot sun. 24. Boisterous. 25. White clouds: fine: clear and frosty at night. 26. Clear: fine: clear and frosty. 27. Cloudy: frosty at night. 28. Cloudy and fine: rain at night. 29. Rain: densely clouded. 30. Cloudy and fine.

Mean temperature of the month	44°·81
Mean temperature of April 1851	44 ·56
Mean temperature of April for the last twenty-six years	47 ·30
Average amount of rain in April	1·65 inch.

Boston.—April 1—4. Fine. 5—7. Cloudy. 8. Fine. 9. Cloudy. 10, 11. Fine. 12. Cloudy. 13, 14. Fine. 15—17. Cloudy. 18. Cloudy: rain A.M. 19. Cloudy. 20, 21. Fine. 22. Cloudy. 23. Fine. 24. Fine: stormy. 25, 26. Fine. 27. Cloudy. 28. Fine: rain P.M. 29. Cloudy: rain A.M. and P.M. 30. Cloudy.

Sandwick Manse, Orkney.—April 1. Clear: fine: clear. 2. Cloudy: fine: clear: fine. 3. Bright: fine: clear: fine. 4—7. Clear: fine. 8. Bright: damp. 9. Clear: fine: cloudy: fine. 10. Clear: fine: aurora. 11. Hazy: fine: clear: fine: aurora. 12, 13. Bright: fine: warm: fine. 14. Bright: fine: warm: fine: aurora. 15—17. Bright: fine: warm: fine. 18. Cloudy: fine: clear: fine: aurora. 19. Bright: fine: clear: fine. 20. Drops: fine: clear: fine: S. aurora. 21. Clear: fine: clear: aurora. 22, 23. Bright: cloudy: aurora. 24. Clear: fine. 25. Clear: fine: aurora. 26. Cloudy: fine. 27. Bright: fine: clear: fine. 28. Cloudy: fine: showers: fine. 29. Fog: damp. 30. Cloudy: clear: fine.

This month has been unprecedentedly fine, dry and warm, with the barometer high.

Mean temperature of this month	47°·64
Mean temperature of April for preceding twenty-five years	43 ·28
Average amount of rain in April for six years	2 inches.

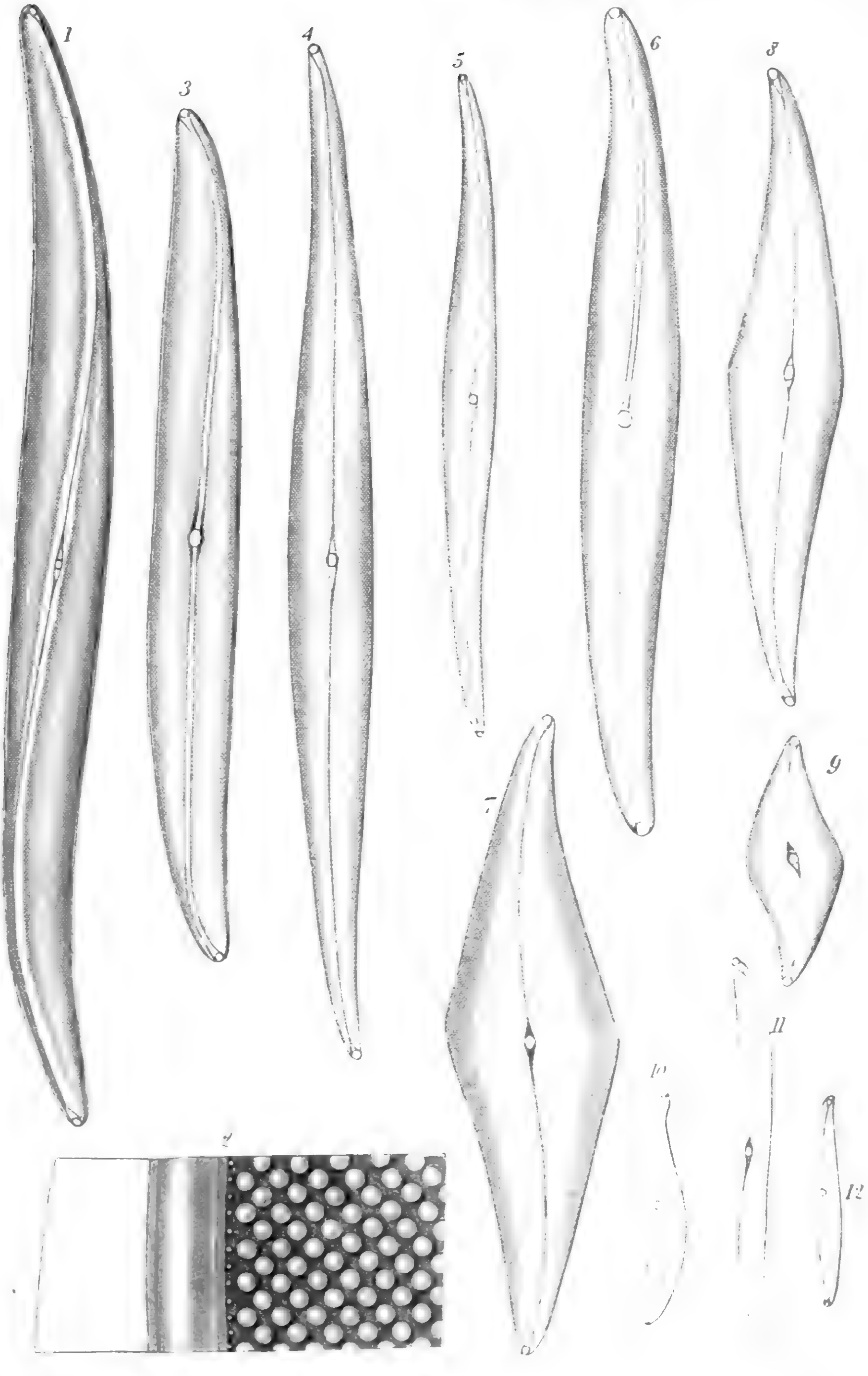
The most singular meteorological phænomenon this month was the perpendicular column of light which appeared above the sun at setting, extending about 15° in height, wider than the apparent diameter of the sun, following his course northwards, and continuing one evening for 55 minutes. It appeared at sunset on the 6th, 11th, 16th, 24th, 26th and 27th, and once or twice before I noted the date, either this month or March, also before sunrise.

Meteorological Observations made by Mr. Thompson *at the Garden of the Horticultural Society at* Chiswick, *near London; by* Mr. Veall, *at* Boston; *and by the* Rev. C. Clouston, *at Sandwick Manse,* Orkney.

Days of Month.	Barometer.					Thermometer.					Wind.			Rain.		
	Chiswick.		Boston. 8¾ a.m.	Orkney, Sandwick.		Chiswick.		Boston. 8¾ a.m.	Orkney, Sandwick.		Chiswick. 1 p.m.	Boston.	Orkney, Sandwick.	Chiswick.	Boston.	Orkney, Sandwick.
1852. April.	Max.	Min.		9¼ a.m.	8½ p.m.	Max.	Min.		9¼ a.m.	8½ p.m.						
1.	30·203	30·015	29·68	30·10	30·16	51	24	40	45	38	ne.	e.	se.	....	....	....
2.	30·303	30·263	29·96	30·17	30·24	52	25	40	47	46	ne.	e.	ese.	....	....	....
3.	30·326	30·246	29·98	30·28	30·33	51	29	39	48	42	e.	e.	se.	....	....	....
○ 4.	30·156	30·147	29·80	30·38	30·36	50	30	43	45½	42	se.	e.	se.	....	....	....
5.	30·141	30·099	29·76	30·20	30·12	58	28	47	46	41½	ne.	e.	......	....	....	....
6.	30·146	30·111	29·73	30·13	30·24	57	39	44	46	45	ne.	n.	w.	....	....	....
7.	30·218	30·150	29·80	30·28	30·35	50	40	45	49	45	ne.	nne.	w.	....	....	....
8.	30·270	30·232	29·89	30·28	30·31	54	28	44·5	50	48	e.	ne.	wnw.	....	....	....
9.	30·312	30·307	29·96	30·29	30·27	53	24	47	49	47½	se.	ene.	wnw.	....	....	....
☾ 10.	30·293	30·189	29·84	30·22	30·18	60	26	45	50	43½	e.	wnw.	......	....	....	....
11.	30·177	30·144	29·84	30·13	30·16	55	38	40	50	46	e.	ese.	e.	....	....	....
12.	30·278	30·236	29·92	30·15	30·16	57	27	44	54	45	e.	s.	sse.	....	....	....
13.	30·313	30·274	29·92	30·19	30·19	68	26	43	52	50	se.	ese.	se.	....	....	....
14.	30·262	30·171	29·80	30·21	30·23	73	29	50	55	51½	e.	nnw.	se.	....	....	....
15.	30·174	30·076	29·76	30·20	30·18	60	41	46·5	54	47	e.	ne.	ese.	....	....	....
16.	30·037	29·987	29·67	30·13	30·10	52	25	44·5	52	48	e.	ese.	......	....	....	....
17.	29·957	29·837	29·58	30·01	29·96	56	31	43	55	47	n.	wnw.	n.	·01	....	....
18.	30·010	29·763	29·47	29·97	30·04	50	34	44	53½	45	e.	ne.	se.	·01	·03	....
● 19.	30·096	30·069	29·74	29·94	29·86	48	20	42·5	50½	47	ne.	n.	s.	....	....	....
20.	30·118	30·043	29·72	29·86	29·99	59	21	36·5	49½	47	sw.	s.	w.	....	....	·03
21.	30·074	29·957	29·72	30·02	29·99	61	37	44	52	44	se.	ssw.	ese.	....	....	....
22.	29·883	29·821	29·53	29·94	30·02	70	43	52·5	49	45	se.	e.	ese.	....	....	....
23.	29·961	29·842	29·50	30·13	30·28	68	42	52	49	45	e.	e.	ese.	....	....	....
24.	29·903	29·896	29·66	30·36	30·32	53	33	46	49	42½	e.	e.	e.	....	....	....
25.	29·922	29·900	29·59	30·27	30·20	54	30	47·5	51	42	e.	e.	......	....	....	....
26.	30·071	29·953	29·64	30·17	30·18	63	27	47·5	48	45	ne.	ne.	ne.	....	....	....
☽ 27.	30·168	30·141	29·74	30·14	30·07	55	25	48	49	45½	n.	n.	se.	....	....	....
28.	30·156	29·974	29·70	29·84	29·71	64	44	49	51½	46	sw.	s.	......	·32	....	....
29.	29·820	29·686	29·32	29·67	29·64	61	50	56	52	47	sw.	sw.	ese.	·18	·03	·08
30.	29·600	29·546	29·10	29·69	29·81	66	44	57	48	45	w.	wnw.	n.	....	·14	....
Mean.	30·111	30·035	29·71	30·111	30·121	57·63	32·00	45·6	49·98	45·30				0·52	0·20	0·11

INDEX TO VOL. IX.

END OF THE NINTH VOLUME.



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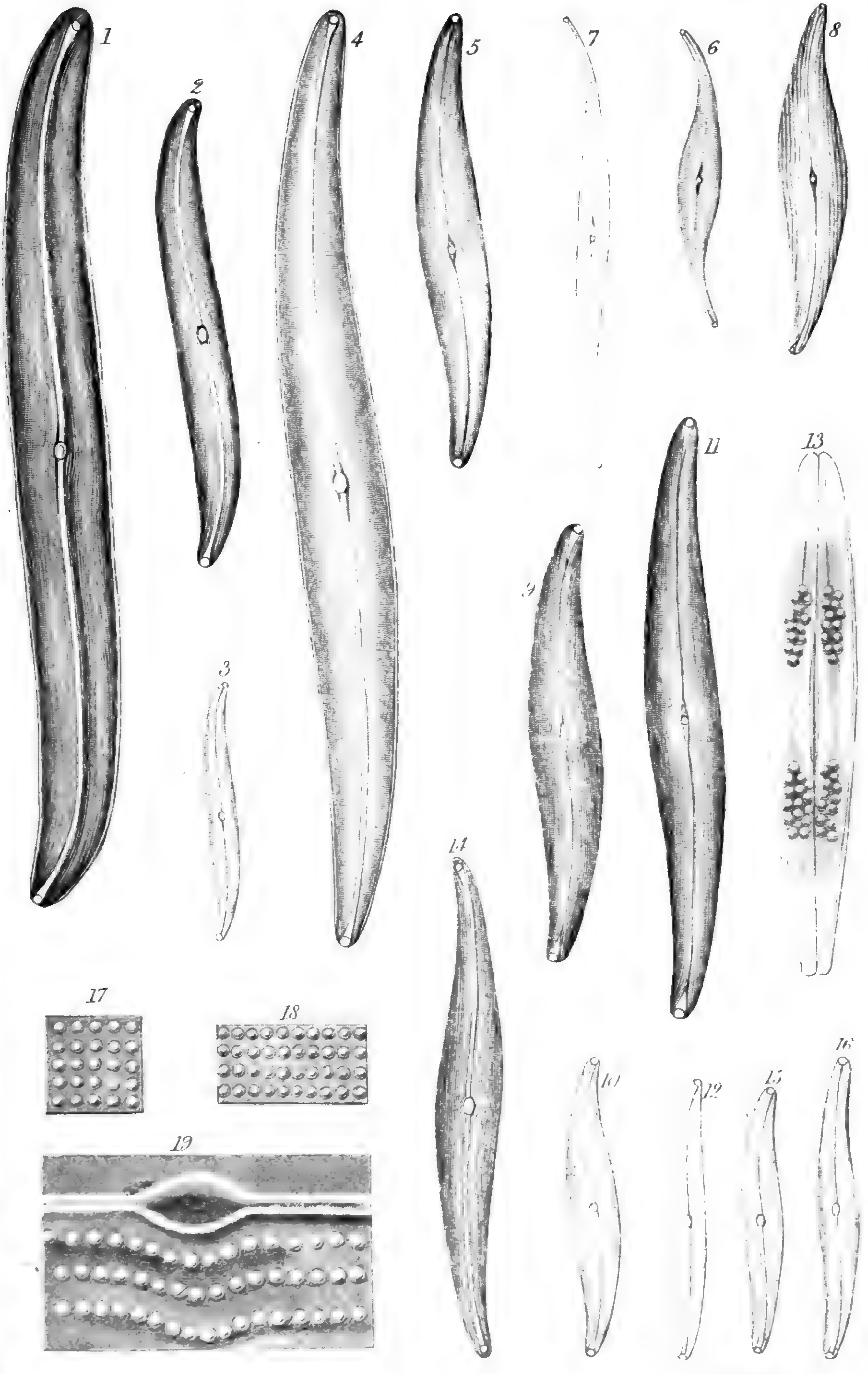

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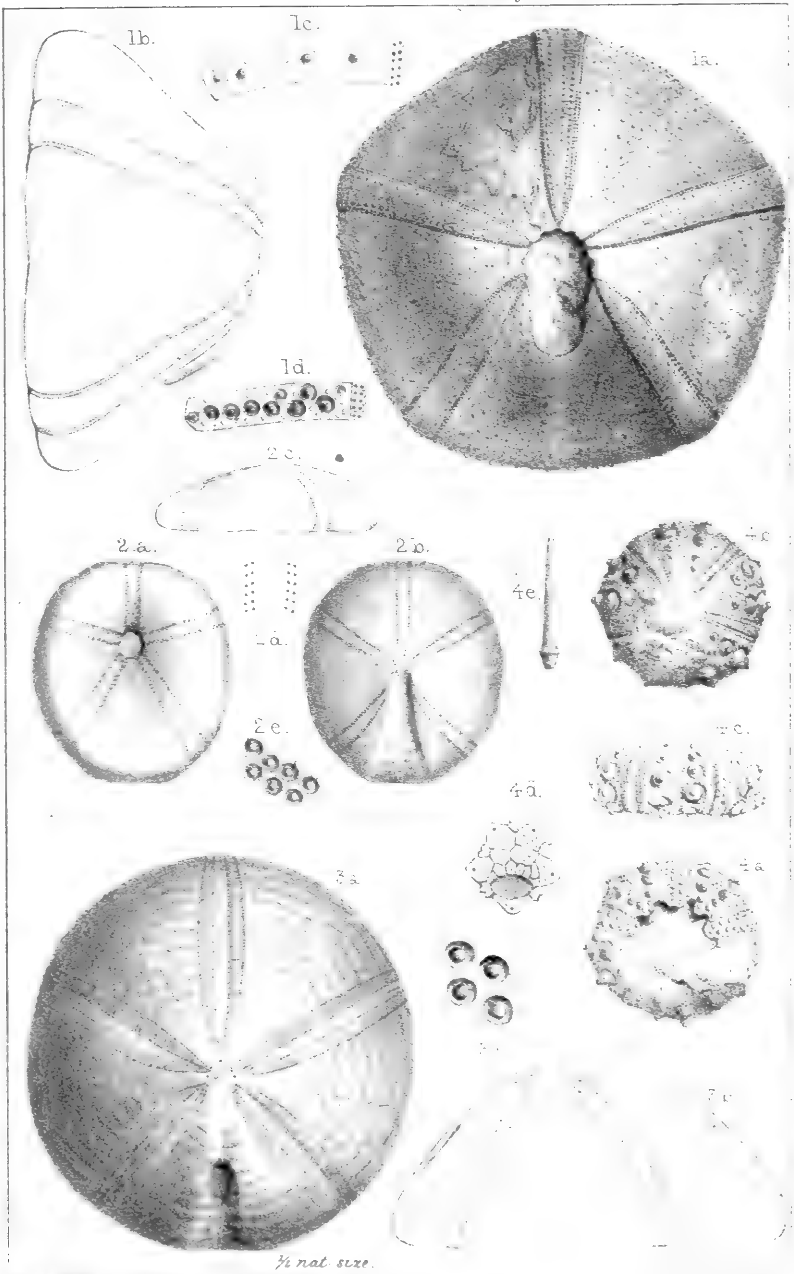

W H Baily

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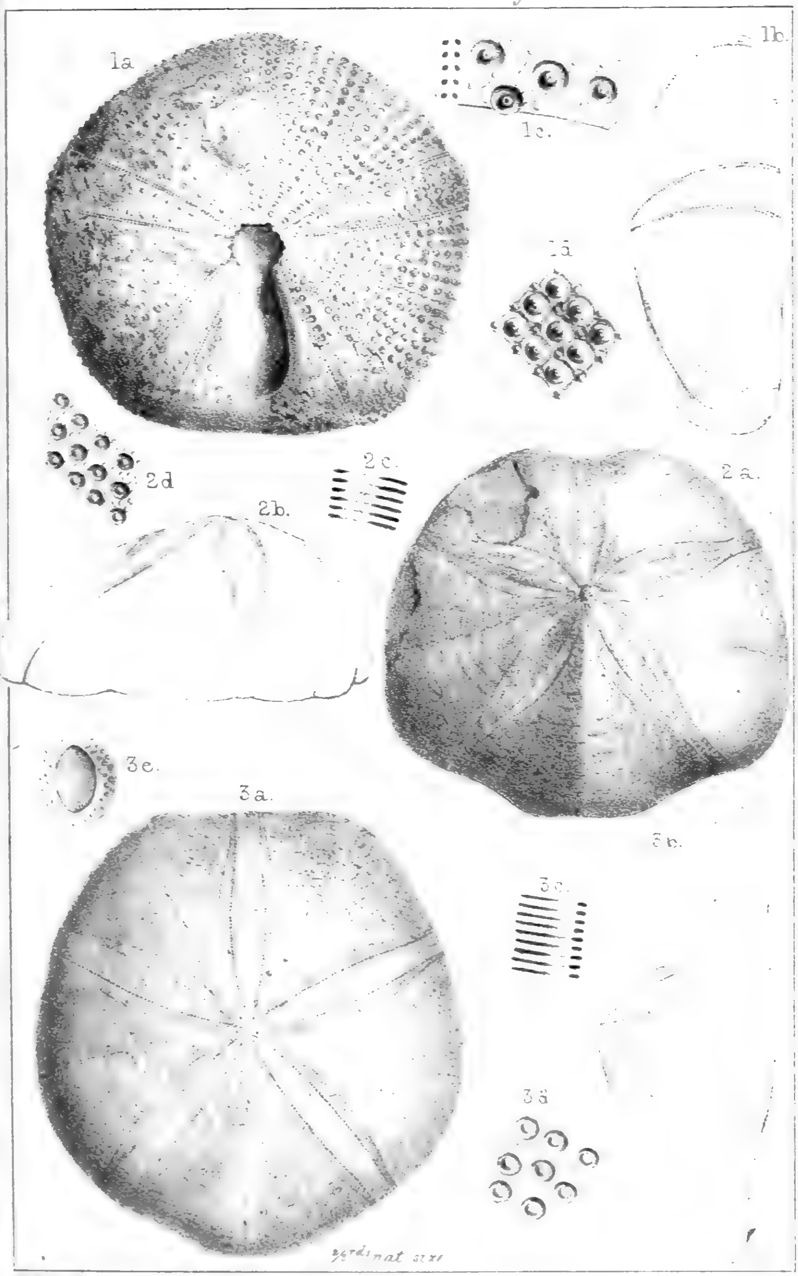
1. a.—d. Pygaster conoideus, Wright
2. a.—e. Hyboclypus caudatus, ,,
3. a.—c. Nucleolites Agassizii, ,,
4. a.—e. Acrosalenia Wiltonii, ,,



W. H. Baily

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1 a – d. Pygaster Morrisii, Wright.
2 a – d. Pygurus Blumenbachii, Koch & Dunker.
3 a – e. Pygurus pentagonalis, Wright.

Fig. 1

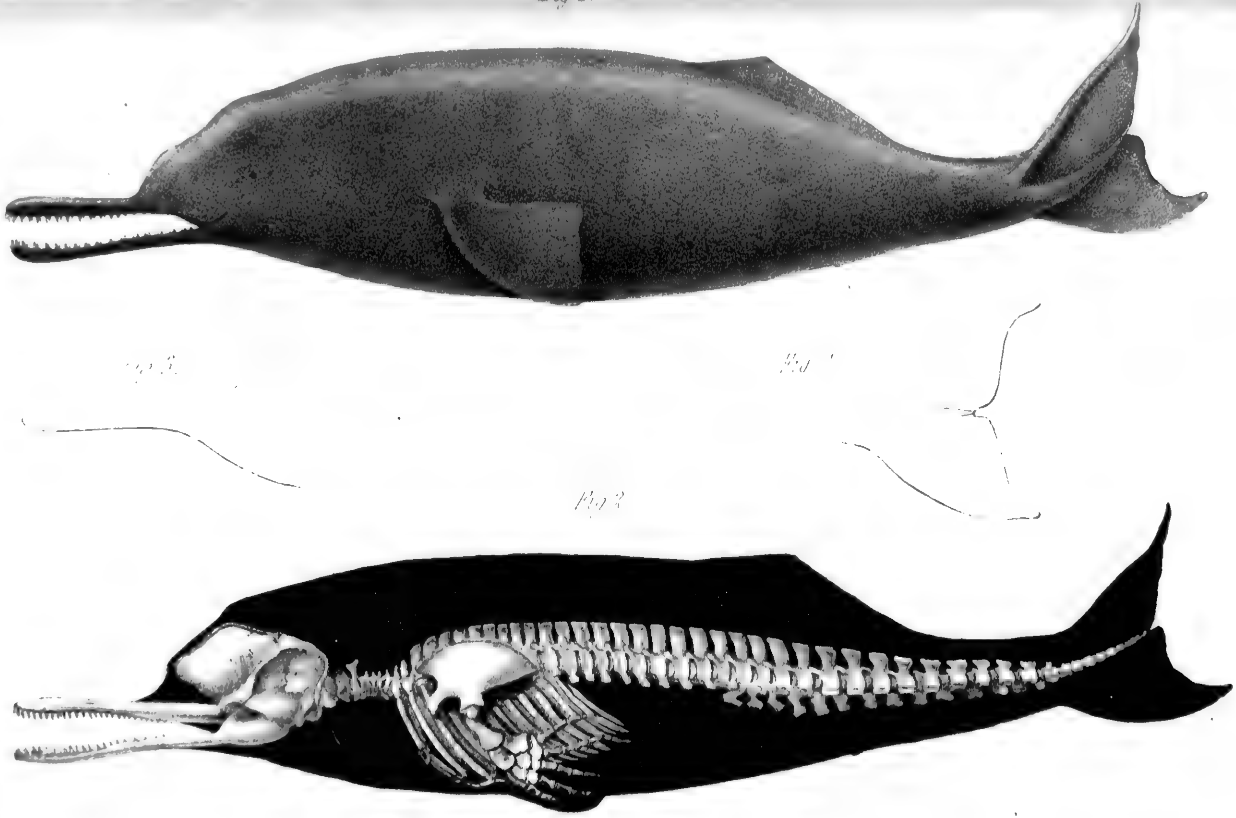

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Fig. 1

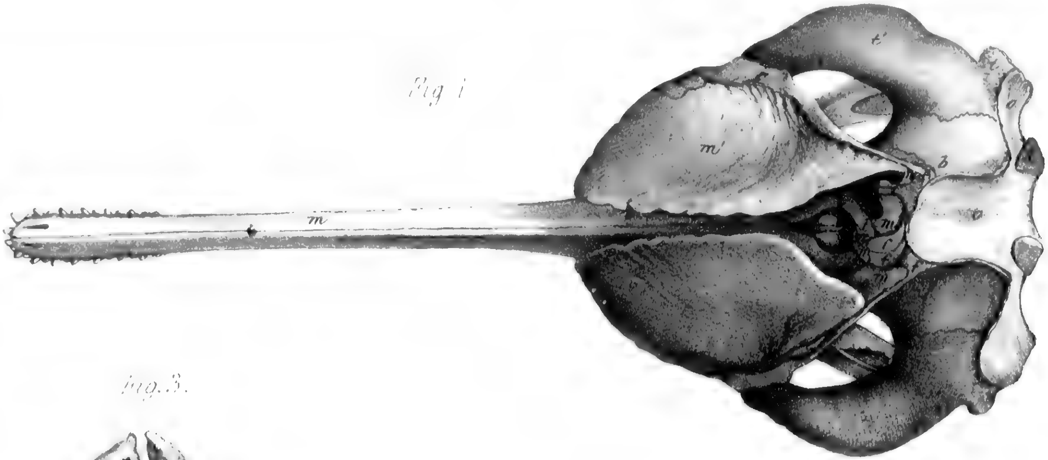


Fig. 3.

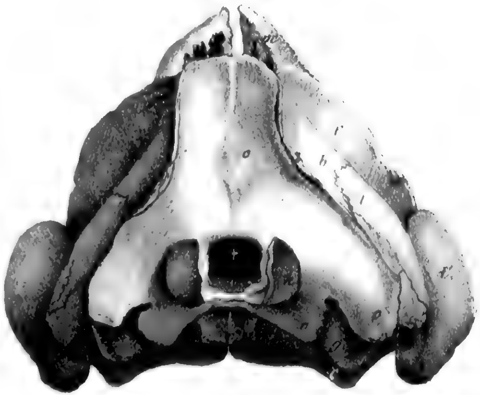
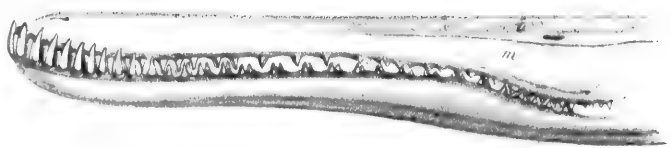
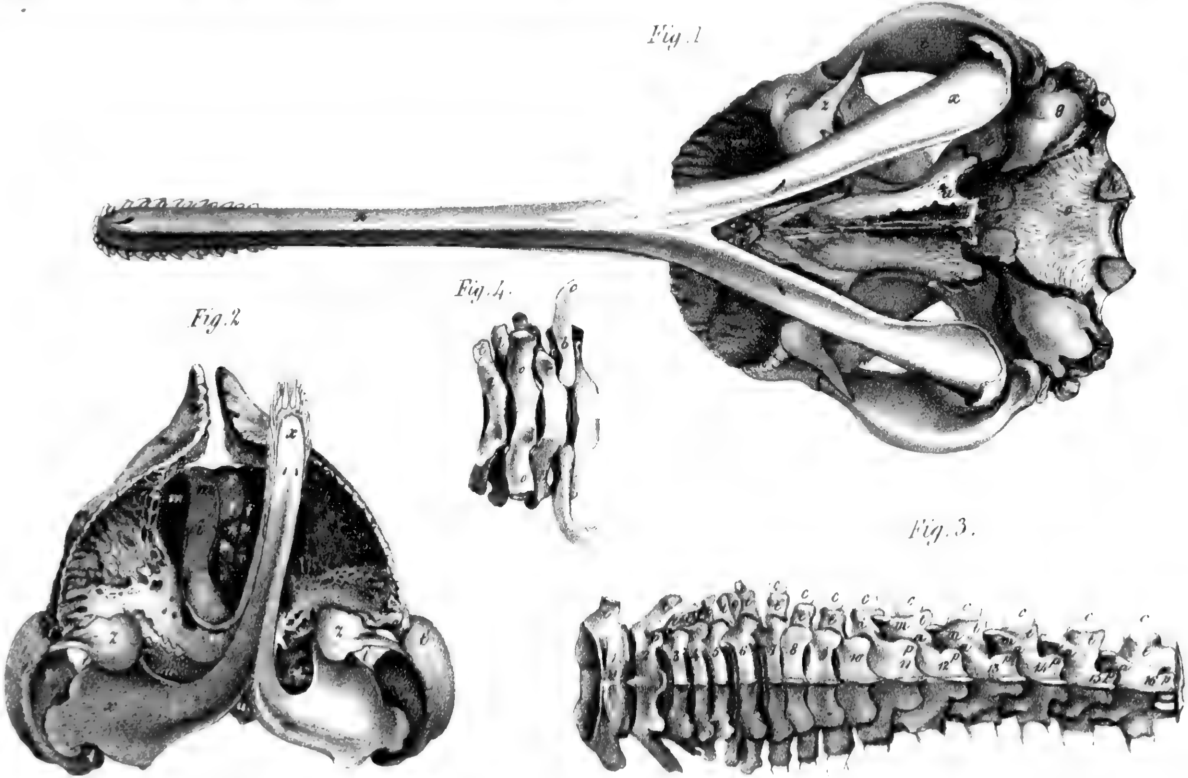


Fig. 2





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Rev.d M. J. Berkeley del.

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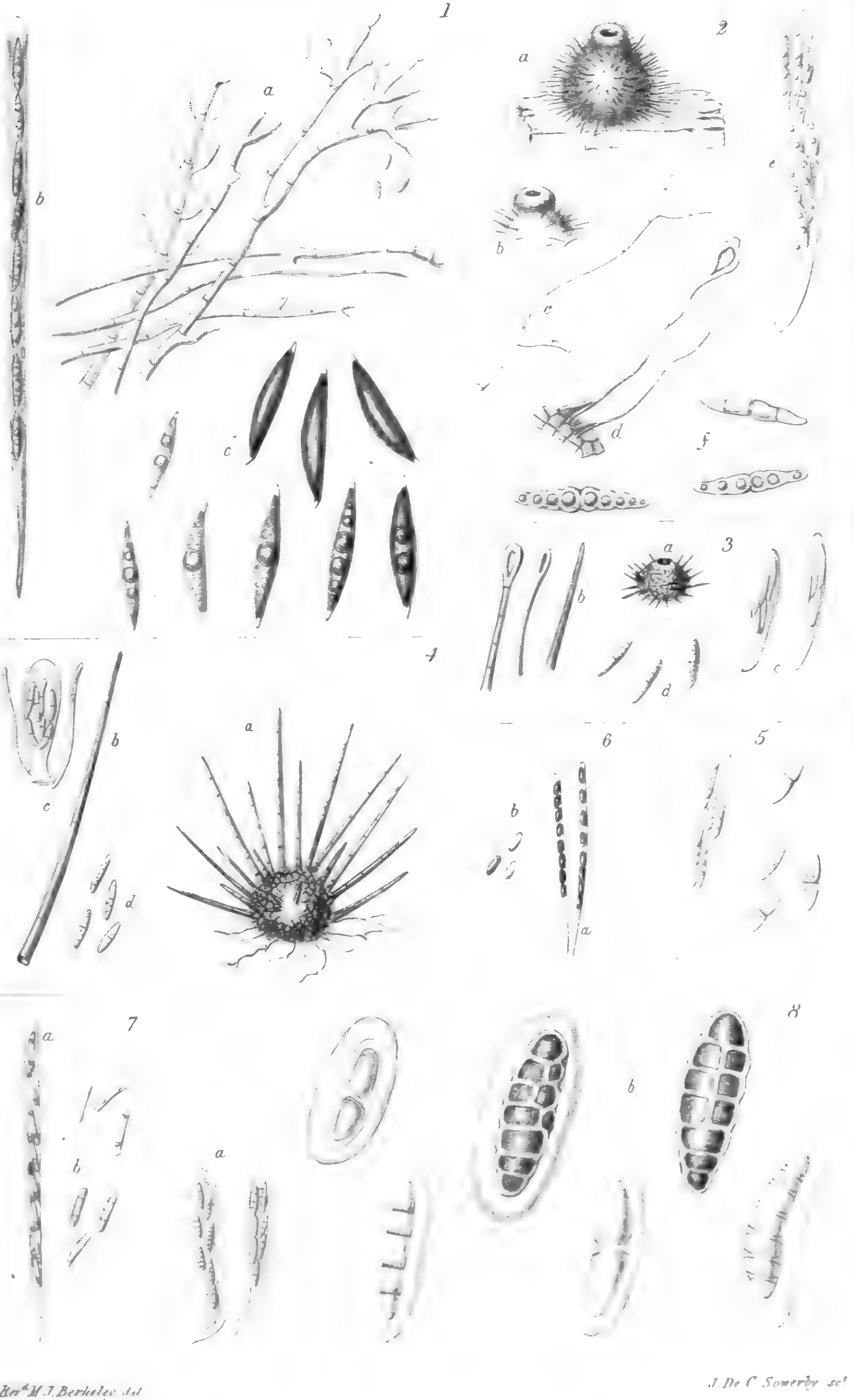

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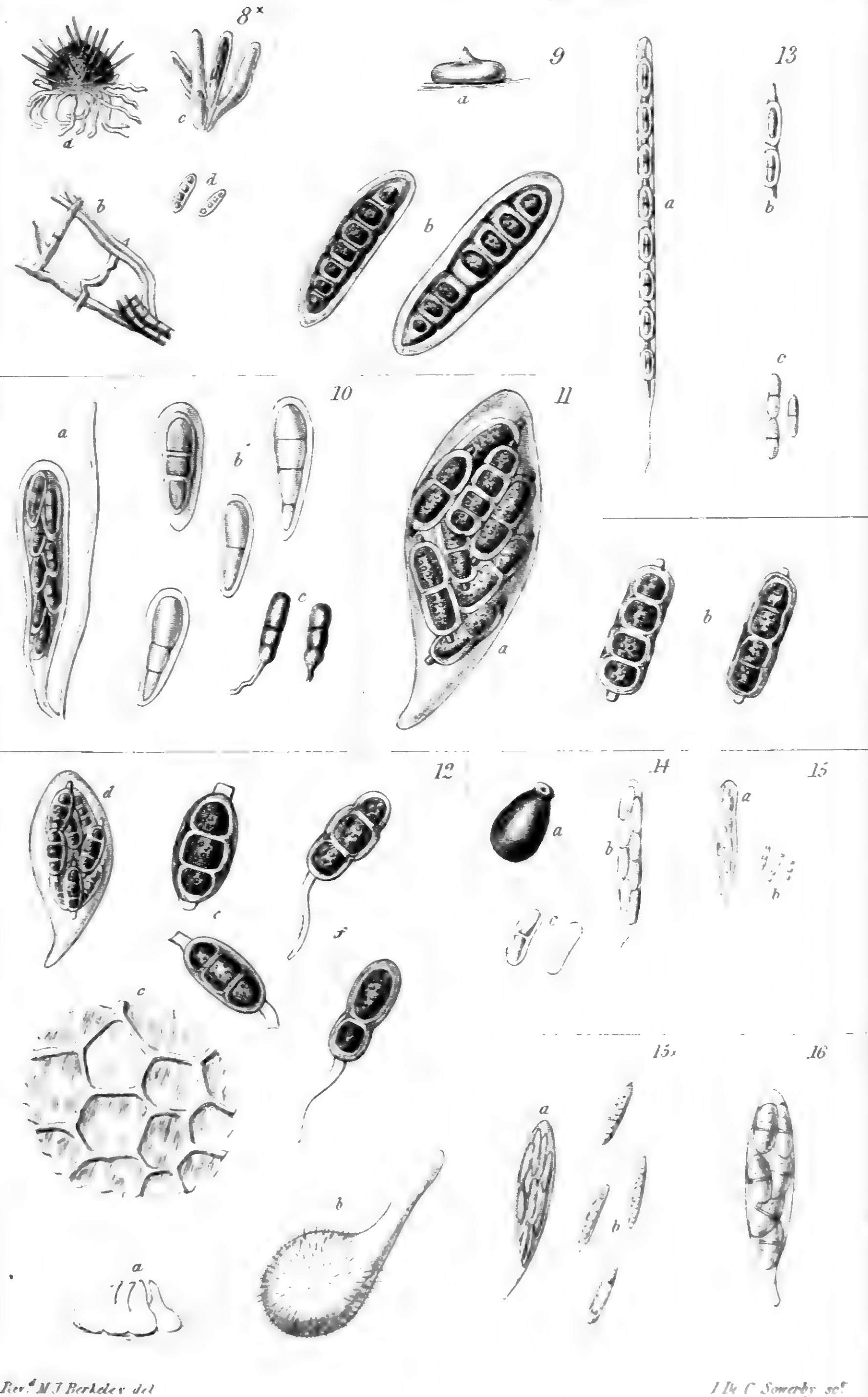

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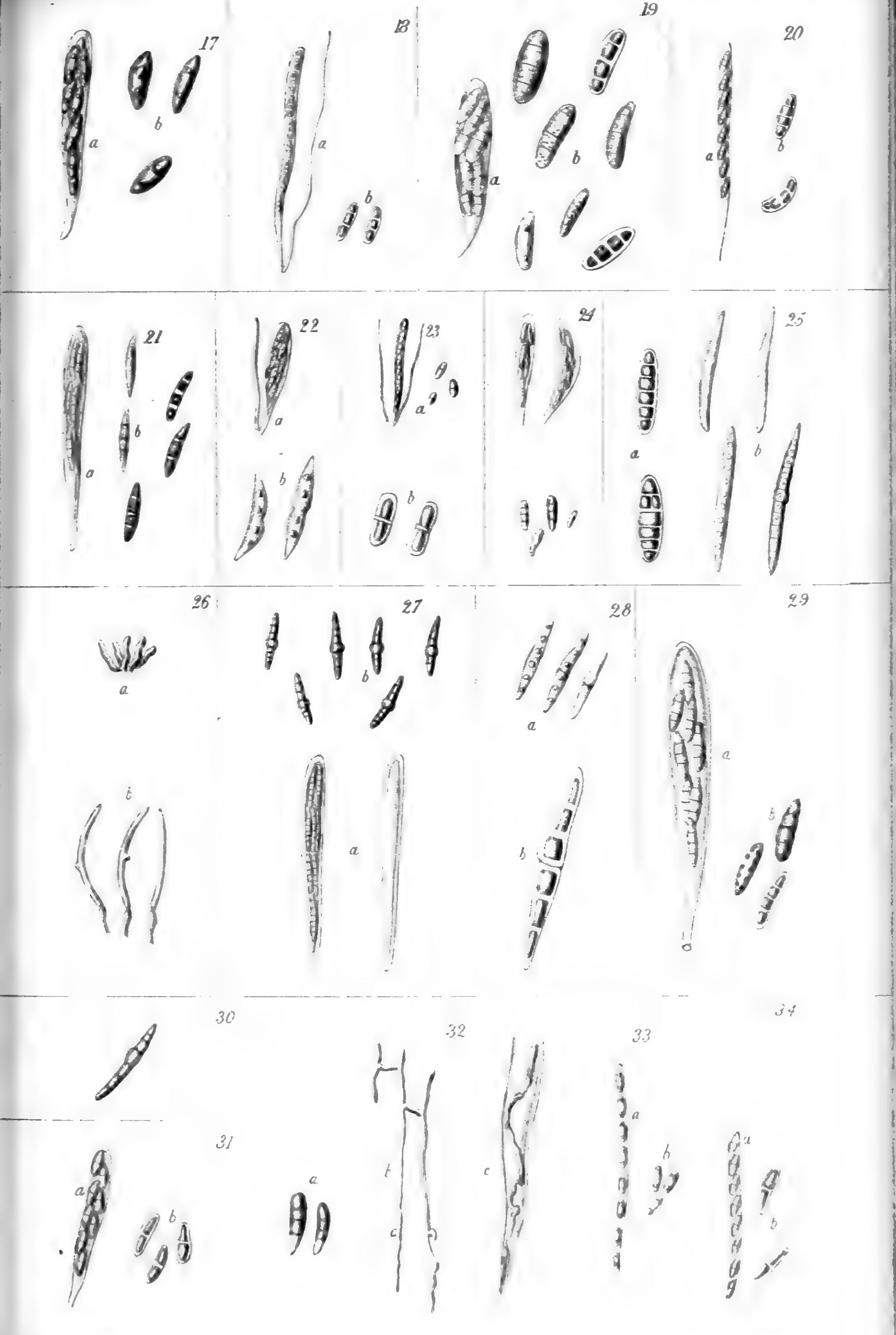

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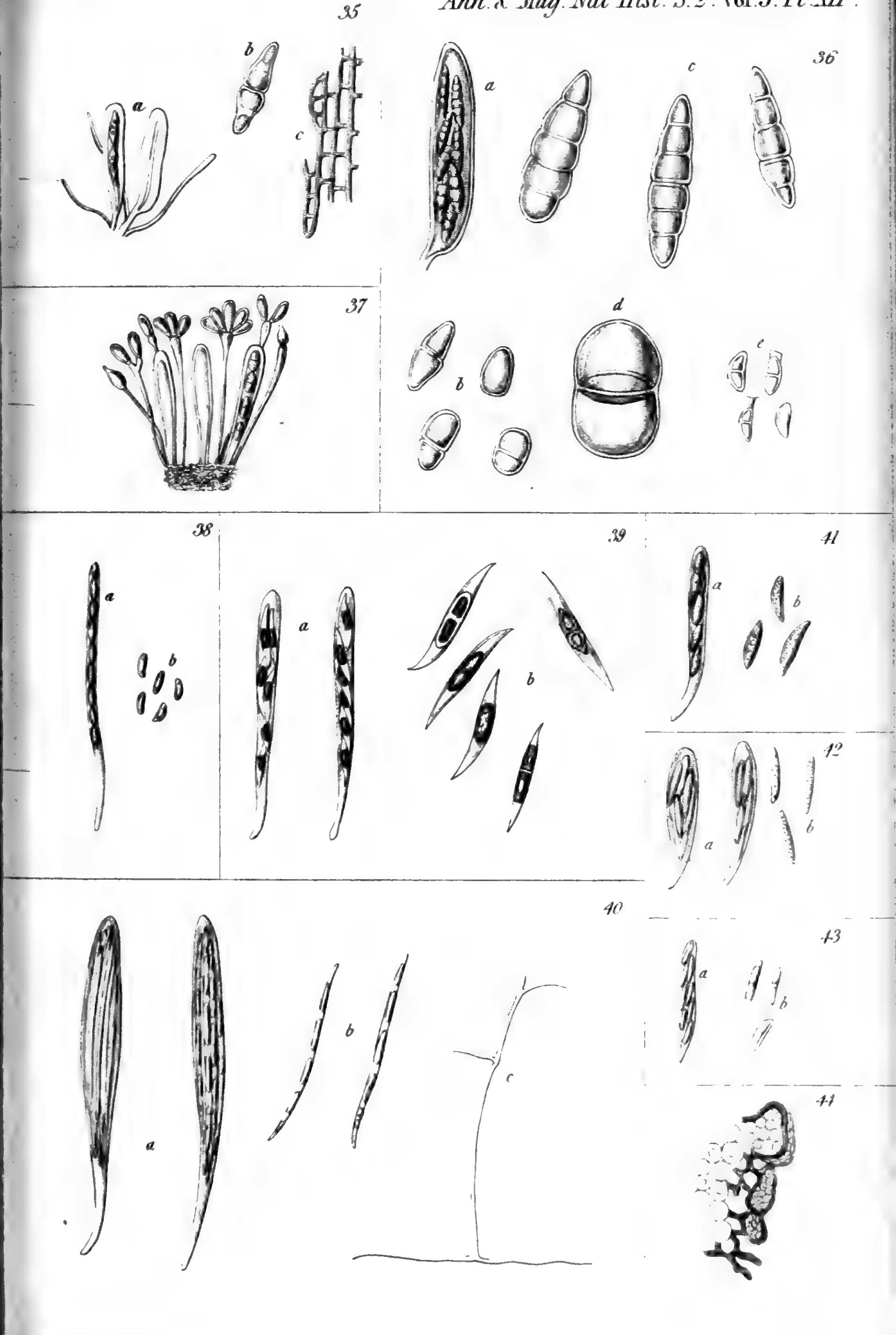

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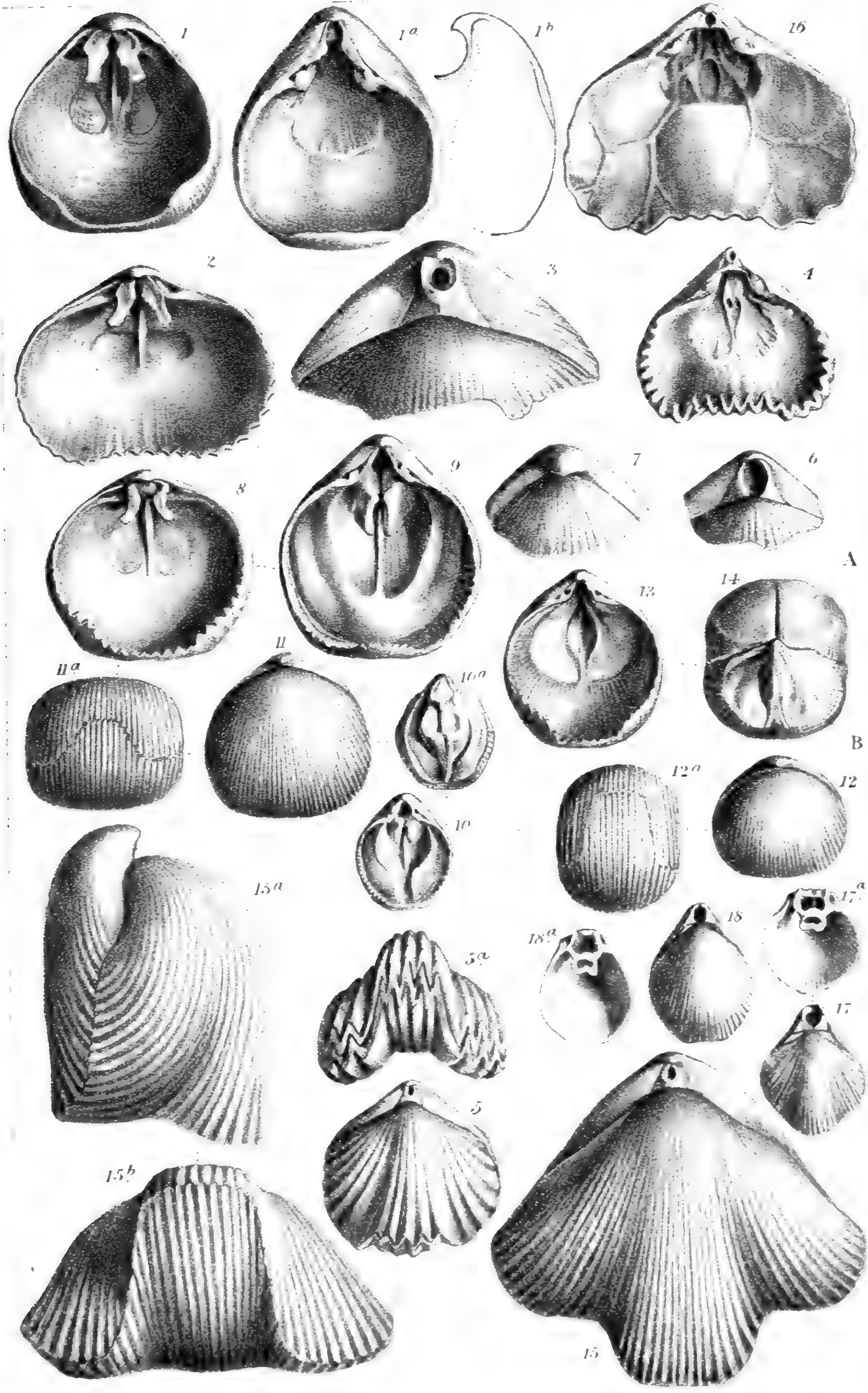

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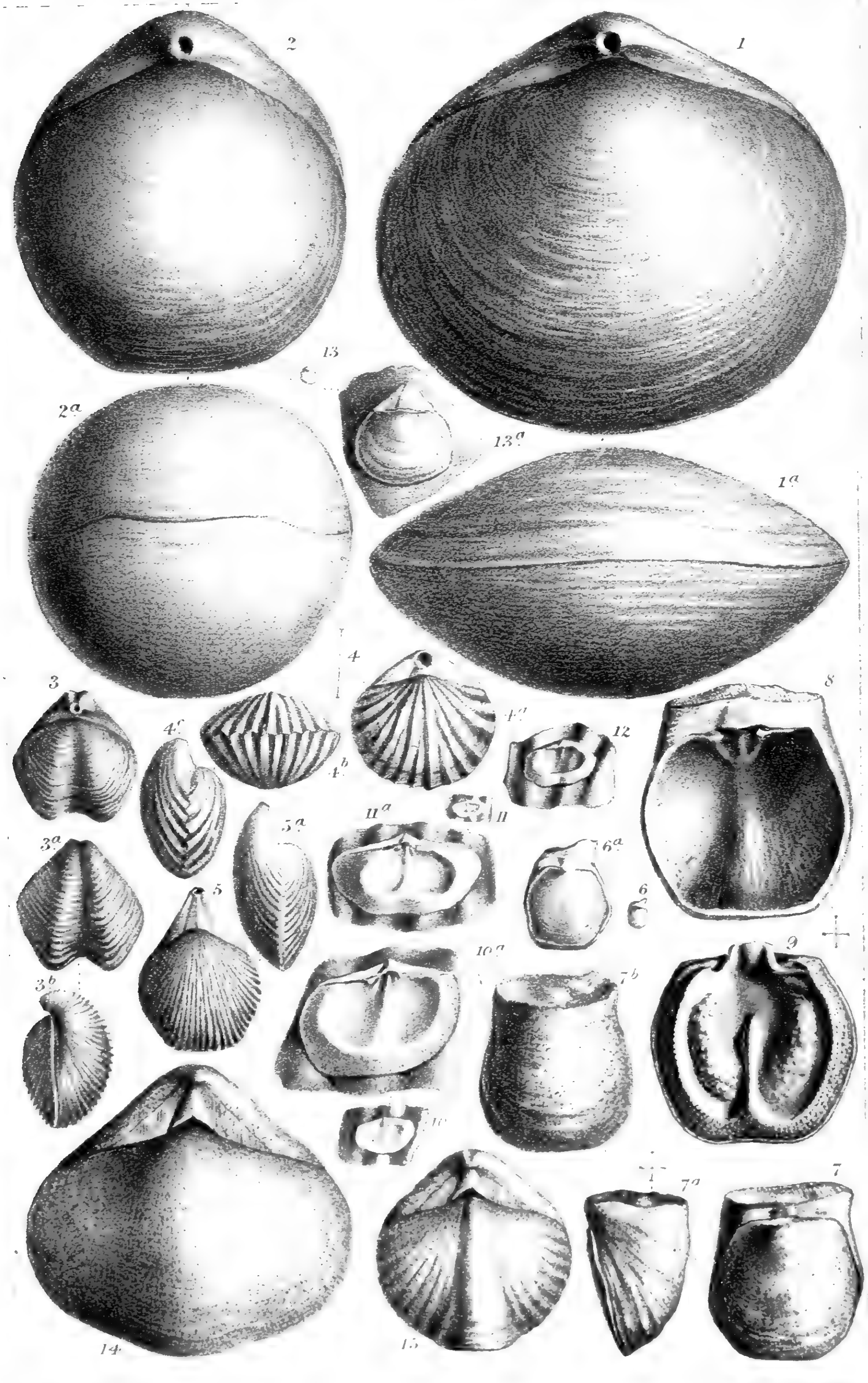
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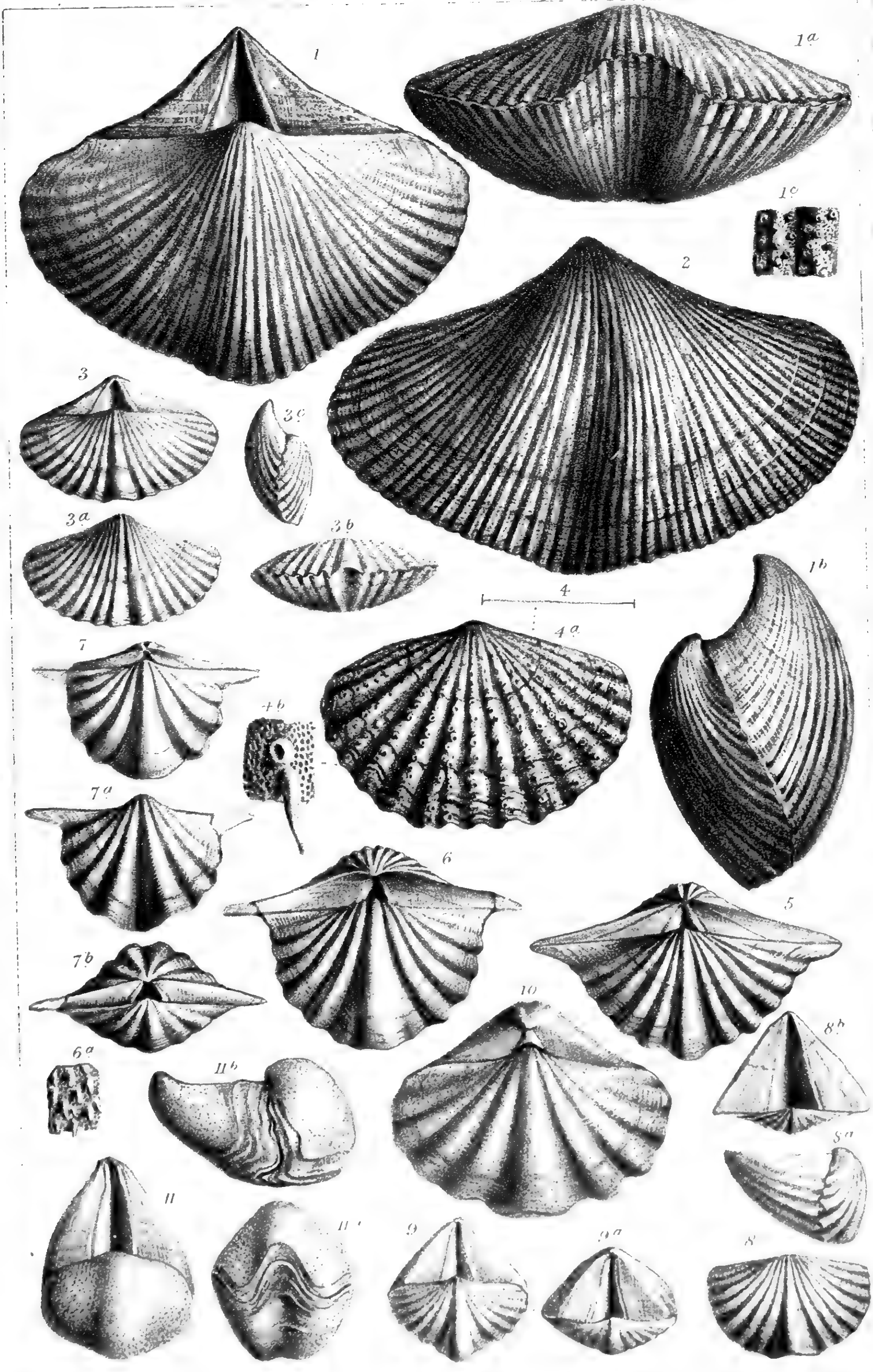
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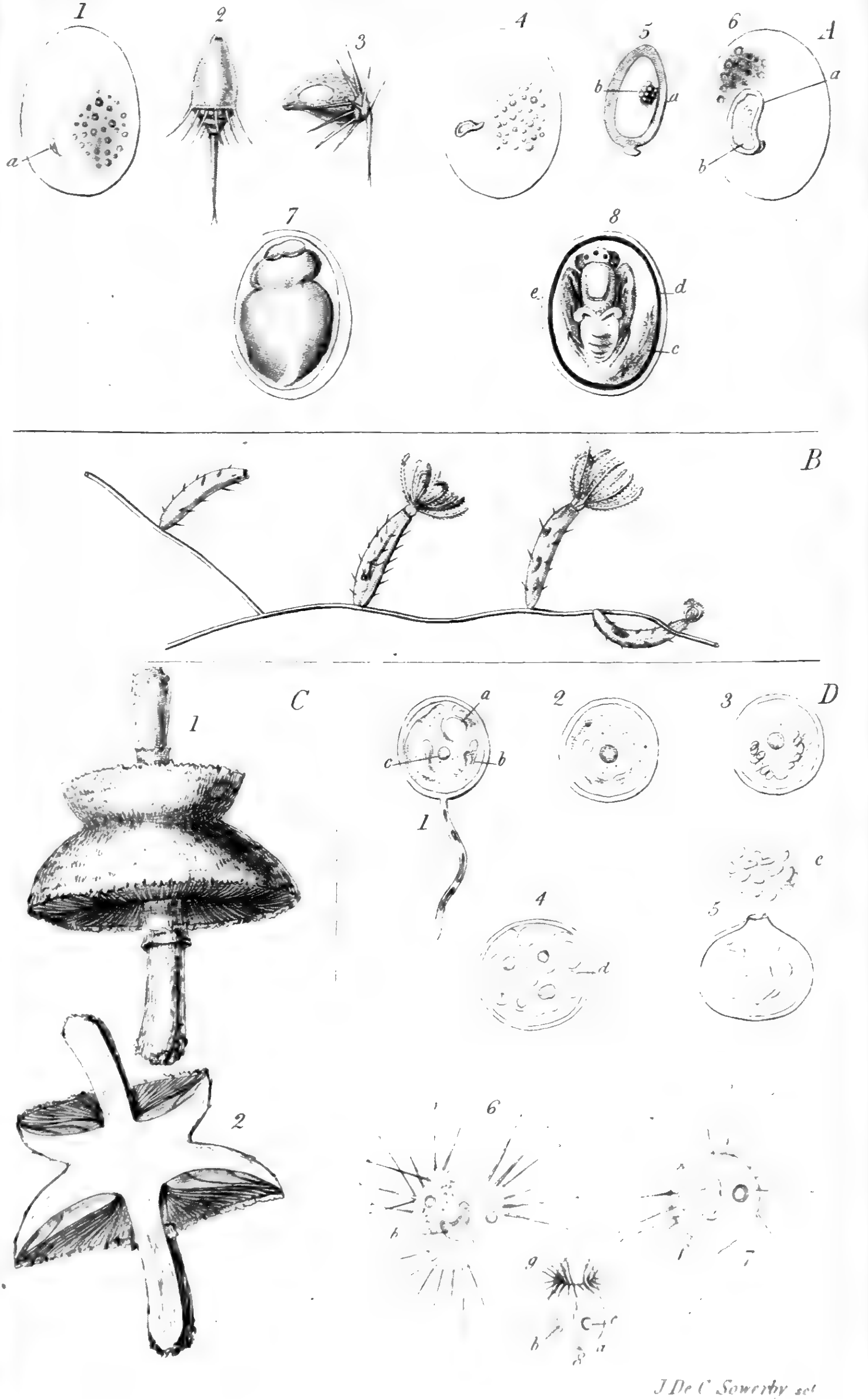
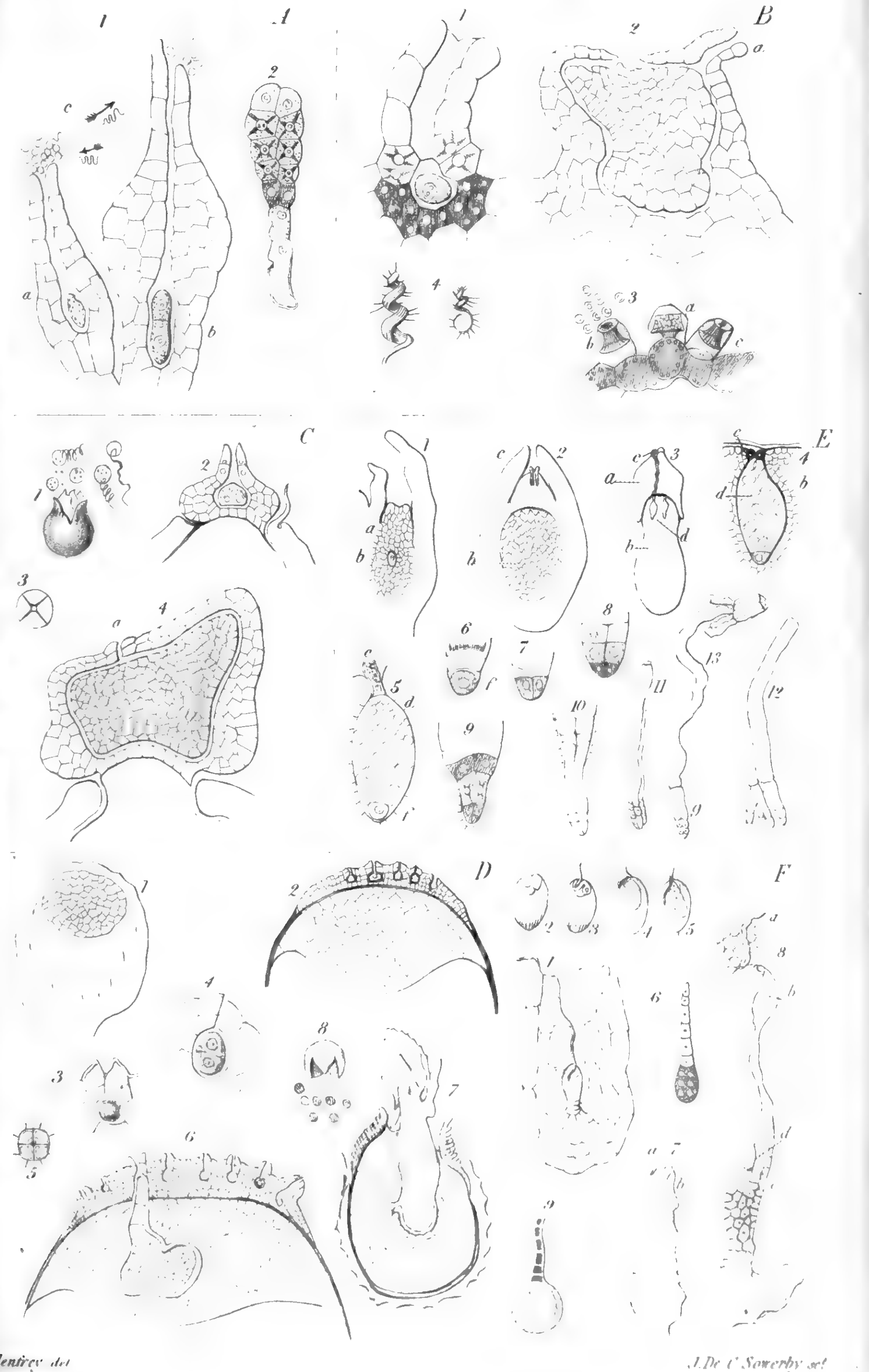


J De C Sowerby sc.



A. Henfrey del. *J. De C. Sowerby sc.*